THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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	Page
The Ethics and Economics of the Lowest Tender	741
International Regulation of Wireless Telegraphy	743
Arc Lamp Tenders	743
Some Considerations of Detail in the Design of Electricity Meters	743
Correspondence :—	
The Want of Co-operation in Pushing Electricity ...	745
On Advertising Electricity	745
The Domestic Load	745
The Education of the Engineer	746
The I.E.E. Students and the New Articles	746
Warning to Inventors and Patentees	746
Midland Electrical Exhibition	746
Central Station Status	747
Notes from Canada	747
Australian Tramway Companies and their Employés.—III ...	747
New Electrical Devices, Fittings and Plant (*illus.*)	748
Parliamentary	749
Legal	752
Electrical Cooking at Earl's Court	754
Business Notes	755
Notes	762
City Notes	764
Stocks and Shares	768
Market Quotations	768
Share List of Electrical Companies	769
Metal Market.—Fluctuations in March	771
The Characteristics of Copper and Aluminium Overhead Line Conductors (*illus.*)	771
Exhibitions and Lectures	773
Proceedings of Institutions :—	
High-Tension Porcelain Line Insulators (*illus.*)	775
Domestic Electricity	779
Expiring Patents (*continued*)	779
New Patents Applied For, 1912	780
Abstracts of Published Specifications	780

Contractors' Column ... Advertisement pages xxiv and xxvi

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THE ETHICS AND ECONOMICS OF THE LOWEST TENDER.

ONE of the questions which no conference, no matter how convened or by what chairman it may be guided, can be reasonably expected to settle, is that of competitive tendering on certain branches of manufacturing. We have not forgotten, in making this remark, that in one branch of electrical manufacturing an Association of manufacturers does, in effect, if not in avowed intention, keep up *quality of output* and prices within the home market. But in that case standardisation has been simple, the price of raw material is a substantial item, and the formulation of the detailed principles of a common policy relatively easy. We have had futile attempts at emulation in some other branches of electrical manufacturing, but the complexity of the interests involved has prevented these projects from coming to fruition. We believe, however, that co-operation is not a wild impossibility. The situation is full of difficulties, and a recognition and discussion of these is of interest.

Let us first consider the mental attitude of the recipient of a number of tenders. A firm of merchants may receive a number of tenders based merely on a schedule of quantities, varying as such tenders always do. The sum total at the foot of the tender has in general far more to do with the placing of the order than the technical details of the pious generalities and details of guaranteed performances bound in a decorative cover which accompany the tender. Of course the personality of the manufacturer's representative has some persuasive value with the buyers, whose ears are filled with the asseverations of Mr. Codlin or Mr. Short. Or again, a large commercial undertaking may decide to purchase some electrical plant. It may not always know exactly what it wants or what is best suited for its requirements, but its first interest in the matter is that of getting some index of the cost. As a start it obtains a price and scheme from some firm, very generally the one whose representative may have first succeeded in persuading it to consider the matter. Then, if not frightened at the outlay, it may ask for other schemes and tenders, and quite conceivably place an order with the firm quoting the lowest price, without regard to technical detail. In some cases, of course, a board of directors may call in a consultant to report on the schemes and recommend one for their acceptance. As no two men see anything from the same perspective, the consultant is probably driven to take up the attitude that none of the proposals coincides exactly with his own view of the needs of the case. One may be unnecessarily elaborate, another may lack important essentials. The prospective purchaser then becomes aware of the importance of requiring tenders all approximately to the same common scheme; the consultant prepares such, and further tenders are invited. Given the capable impartial consultant who does not embroider a scheme with pretty and costly frillings, tenders become

more strictly comparable, and a true, if not always superficially apparent, saving of capital outlay results. This, however, must not be held to imply that the position of the impartial consultant is an easy one. Pressure is often exerted to induce him to invite or to receive tenders from firms in whom he may not have full confidence, and he will at times find it hard to justify to a board of directors the acceptance of any but the lowest tender.

At this stage in the negotiations, serious developments have been known to arise. The magnitude of these in the case of a large and complex project will depend upon whether or not an "omnibus" specification has been issued to, say, four firms, leaving them to obtain sub-tenders for divers items such as boilers, cables, turbines, or tramway poles. The alternative is to sectionalise any big scheme into its distinctive divisions, and obtain tenders on each of these. The evil which may happen will in the latter case be localised, but it is none the less a serious evil. It is axiomatic that, when once the tender is in, no deviation should be permitted. Yet one has heard of Dutch auctions, and one does know that honest consultants have thrown clients up in disgust because of their introduction in such cases. Equally it is alleged, and we fear with some justice, that certain persons engaged in an advisory capacity have in their arm-chairs played the part of the auctioneer. The contractor is squeezed in his price. He is told in effect that "so-and-so is offering to do it 10 per cent. cheaper than your price, if you can meet us then, of course, &c." In such cases the lowest tender, if not accepted, becomes the lever in depressing the prices of firms of better repute. With the "omnibus" type of tender, matters may be much worse, and the huckstering of the Dutch auction may be repeated between the main and each sub-contractor. It is argued, therefore, that it is desirable that this type of specification should disappear, for absolute impartiality on the part of the consultant cannot prevent the "squeezing" policy being carried out in the provinces in an accentuated form. The factor which has produced the omnibus tender, particularly in lighting, traction, or power schemes for places abroad (where one firm has undertaken the contract not only for supplying plant, but also for erecting and handing over a completed installation), has been the centralisation of responsibility between the purchaser and contractor. It is not impossible to indicate a *via media* between the risk of squeezing contractors for machinery by the main contractor and the centralisation of financial responsibility in these cases. Too much may, however, be paid for centralised responsibility. From the point of view of economy in capital and economy in departmental administration of the factory, the omnibus specification is not efficient. If six firms are asked to tender for a contract with, say, a dozen distinctive sections, of which two-thirds come from outside their own works, it falls upon each of the six main firms to get out comprehensive prices, and a multiplicity of drawings, and to co-ordinate purely for tender purposes the component items of their scheme. It is quite obvious that this extra work has to be paid for, and it is more efficient to pay one man for doing it than to have the whole industry saddled with the cost of unnecessary duplication.

The evil of the omnibus tender is not unknown, but it exists in a less degree, even in such a simple subject as a direct-coupled generating set. In this case, we believe that certain of the firms concerned are, by united action, endeavouring to stop the abuse in question. Hitherto, however, the efficiency of their intelligence departments in ascertaining the exact figure at which some other firm is tendering, or has tendered, might well put to shame the intelligence departments of the offensive and defensive forces of any civilised power.

The lowest tender requires to be considered in another aspect, as it can be said to be due both to artificial and to natural causes. We have discussed the artificial causes which lead to the lowering of tenders. Well known though the causes are which underlie what we may term the naturally produced lowest tender, their recital and discussion at this juncture will, at least, serve to indicate the complexity of the problems confronting those who would engineer any understanding between rival firms whereby the average price of any line of manufactured articles might be raised. It is quite obvious that the price at which any article can be manufactured for sale in any given market must depend upon (*a*) the price of the component raw material; (*b*) the actual cost of the labour requisite for its construction; (*c*) the standing charges of rent, salaries of the staff, wear and tear or renewals of machine tools or other plant, correct ratio of allowance for repayment of capital expended on patents; and (*d*) the desired margin of profit on the transaction. Of these, the first is outside the direct control of the works, although judicious provision on the part of the purchasing department will count for much; the second is, to a certain extent, capable of modification if a number of machines of the same size are going through the works simultaneously. But in regard to the third and fourth, anxious problems arise. Standing charges are for any given factory a lump sum of an irreducible character, but vary in the percentage on any job as the works output varies. In times of slack trade, with one or more departments working short time, any board of directors is tempted to forgo an actual profit margin on an order which meets its ratio of standing charges, as, thereby, actual financial loss on the year is minimised. Carried too far, this spells absence of dividends, while lowering prices all through the industry, and it has been known to be the root cause of severe losses of invested capital. It is difficult, however, to imagine that competition between independent firms can under any modern conditions be so inspired as to prevent firms tendering at low prices for this cause.

Another cause which accounts for an unduly low tender often being put in at a time of trade activity, is under-quoting by a firm desirous of entering upon a certain market or of supplying the first of a new type of machine from their works.

Frankly, the lowest tender, if naturally produced by the deliberate lowering of prices to a margin permitting little or no profit, or if artificially inspired by the contemptible artifices of the Dutch auction, is a curse to the industry. Nothing can be urged against a lowest tender when that tender does permit of the work being done, contingencies of defective raw material allowed for, standing charges met, and a proper profit margin secured to the manufacturer. But every tender which does not cover these is contributing to the ruin of the industry concerned. While the type of lowest tender we have criticised does very little good, and may even do much actual harm to the purchaser who is not well advised, it means a squandering of the money invested in the industry, and is an absolute bar to the securing of more capital. It must not be forgotten that manufacturers have to buy their capital just as they buy, say, their pig iron. Capital is only the means whereby the factory buys material and labour, and has to be paid for even as a steel forging has to be paid for.

One grants, of course, that the progress of invention has continuously cheapened manufacture, and that the incentive of competition has produced such devices as automatic or semi-automatic machine tools. It is, moreover, well-known how each year the increase in knowledge of the properties of materials or the invention of new processes tends to cheaper manufacture. All these are not only legitimate aids to cheaper tendering, but are a necessity of continued national industrial existence. Against these forces one has to reckon illegitimate methods of tendering by which the lowest tender, as has been shown, may be produced by unworthy artifices or by a reckless competition. A course of such tendering only acts as a deterrent to investment when further capita becomes necessary at times of great activity. Any industry so weakening itself is indulging in a slow form of suicide. The condition unfortunately is more easy of diagnosis than of cure by any other than the brutal but inevitable remedy of the weaker going to the wall.

International Regulation of Wireless Telegraphy.

A COMMUNICATION from Berlin recalls the circumstance that the United States and Italy have not yet given their adhesion to the International Convention with regard to wireless telegraphy, whilst Great Britain has only become partly associated with it. Hitherto the British Government has declined to make wireless communication compulsory as between ships, and has only joined the Convention so far as it concerns traffic between ship and land stations. The Berlin intimation submits that it may now be reckoned on that the United States will adopt the Convention and ratify it. On the other hand, the Italian Government has entered into negotiations with the Marconi Co. in order to obtain a free hand in respect of association with the agreements between the other countries. If the negotiations should lead to no result up to the time of the International Conference, to be opened in London on June 4th, it is said that the Italian Government will not send any representatives to the Conference. The British Government is not contractually bound to the Marconi Co. by definite agreements which would prevent the former from becoming fully connected with the International Convention. It is now reported that the British Government will express its agreement with the remaining regulations of the Convention, and this assumption is said to be all the more justified as the invitations to the conference have been issued from London, and the management of the Convention rests in British hands.

Arc Lamp Tenders.

BETWEEN two and three years ago a number of firms protested, in our "Correspondence" columns, against the demand of a certain Municipal Corporation that a considerable number of arc lamps should be forwarded as samples with tenders. We supported the protest, feeling with some of the tenderers that the burden thus put upon the arc lamp industry was unreasonable, and out of all proportion to the value of the business to be done. The protests drew from the engineer an explanation of the reasons that had influenced him in making the stipulation, but we should have hoped that borough electrical engineers generally, profiting by reading the whole of the letters, would have sympathetically studied the matter from the standpoint of the manufacturer, and adopted a more considerate course thereafter. In the rush and hurry of the life of city officials, however, some things are apt to be forgotten, and so it came to pass recently that the Dublin Corporation, in inviting tenders for flame arc lamps and suspension gear, issued a specification and conditions which contained clauses that the Arc Lighting Committee of the B.E. and A.M.A. could not accept, and, in the terms of an official notice issued by the Association, "its members deemed it advisable not to tender for the contract unless certain unreasonable clauses of the general conditions and the specifications were altered." Each tenderer was to be prepared to leave on deposit for trial for an unstated period as many as 22 arc lamps, and the terms of settlement were far from being satisfactory. On these and other grounds most of the principal firms in the arc lamp industry preferred to have nothing to do with the matter unless the Corporation amended its demands. We believe that the upshot of the protest is that new specifications are to be issued, and we hope that these will be found to show that regard for the proper interests of the electrical industry which every borough electrical engineer should consider it his privilege to exercise.

We believe that there is reason to be satisfied with the improvement that has taken place in municipal specifications since we made a weekly practice of drawing attention to the hardness and ambiguity of clauses and stipulations that occurred in many of them, and we hope that the recent strong action on the part of arc lamp makers in the case of Dublin will bear good fruit in all departments of the industry, by making it clear to the municipal mind that tenderers have rights as well as privileges, and one of these rights is reasonable consideration.

SOME CONSIDERATIONS OF DETAIL IN THE DESIGN OF ELECTRICITY METERS.

BY "X. Y. Z."

AN electricity meter is an article which has to be designed to satisfy a variety of requirements. The two most important are, perhaps, those of accuracy and cheapness, for these are the two factors which will mainly determine the sale of a particular type of meter. It has, however, to be borne in mind that a meter is not only bought and checked in the test room, but is also fixed and refixed—often many times during its useful life—on various premises. Moreover, it has frequently to be adjusted, and sometimes to be taken apart, cleaned and recalibrated. Whether or no these operations can be carried out easily and expeditiously depends largely upon the attention given to detail in the design of the meter. A meter having three dials, equilateral triangle fashion, the tens dial being above the hundreds and units is liable to be read wrongly if it be fixed in an awkward position in a dark cellar, although such a mistake would never occur in the test room. Or again, if the clamping device of a meter is not plainly marked, it is liable to be brought in unclamped by a careless meter fixer, and, as such a man will naturally be the least careful in carrying the meter, to suffer considerable damage.

It is the purpose of the writer in the article to deal with those points of detail which do not affect the fundamental design of the meter, or the cost of its manufacture, but which apply to nearly all types, inattention to which causes the meter to be a source of vexation to the repairer and tester, and to become unpopular with those people who have to look after it.

It is a source of great annoyance to have the top bearing of the armature spindle attached to the counter. In investigating the cause of failure of a sluggish meter, it is exceedingly inconvenient not to be able to run the meter without the counter, and if for any reason the counter has to be removed during the examination of such a meter *in situ*, its replacement is somewhat difficult. The method of fixing the counter is of considerable importance. Means should be taken to ensure that the counter, after being removed, can be replaced exactly in its original position. This can be accomplished by the provision of steady pins and an ample bearing surface. In this matter the Chamberlain & Hookham meter is, in the opinion of the writer, unequalled. With this meter, it is necessary merely to slacken the fixing screws in order to remove the counter, and it can be quickly replaced without any need of subsequent adjustment. It is very desirable that the dials be large and clear and plainly marked, and this is especially the case with large meters with no units dial. The provision for short-time tests varies very much among the meters now on the market. There would seem to be very little difficulty in designing a counter that would enable readings to be taken to one-thousandth part of a unit, but this provision is not often found. The superiority of the time over the revolution test is so generally recognised that it is a little surprising that greater facilities for taking short-time tests are not given. Many cyclometer counters now in use are far from satisfactory. They are frequently made so that it is necessary for the eye to be level, or nearly level with the figures for a reading to be taken, and the figures, moreover, are often so small as to be almost unreadable excepting in a good light. The only object of a cyclometer dial is to enable quick and accurate reading to be done, and it is of no advantage to the meter reader to have his reading in actual figures if he has to get a ladder to see the meter, where, with a good clock counter he could have read it standing on the ground. It should not be necessary to remark that the figures on cyclometer counters referring to decimal parts of a unit should be clearly distinguishable from the rest. This is not the case, however, with at least one modern electricity meter. In this connection it may be said that, in addition to the difference in colour of the decimal figures, it is a great advantage to have a prominent comma marked on the counter to show the position of the decimal point used in

this country. Cyclometer counters with a jumping attachment are very convenient if they work well. The writer saw the other day, a meter with one of these counters, in which half figures were showing on two dials, while the units opening was completely closed by a shutter. In such a case as this it is at least as easy to read an ordinary clock dial. An arrangement for setting cyclometer counters to zero without removing them from the meter is useful. Before leaving the consideration of this part of the meter it may be advisable to mention the advisability of making the pinion on the armature spindle of phosphor bronze in the case of those meters having spur gearing from armature to counter. The risk of rusting is frequently considerable with a steel pinion if the meter be fixed in a damp place, and the effect of rusting is, of course, most felt on the armature spindle, where the torque is lowest.

The methods of adjusting the meter when it is inaccurate are divisible into two classes, that in which the speed of the meter is altered, and that in which the gearing in the counting train is arranged to suit the new speed. It is a pity that greater facilities for this latter operation are not provided by meter manufacturers. When a meter shows an inaccuracy which is constant at all loads it is by far the most convenient method of standardising to make an alteration in the wheel train, provided the counter is suitably designed for this purpose. Change wheels should have the number of teeth clearly marked, and these teeth should not be too small, otherwise it will not be easy to get the new wheel to gear properly. The speed of an inaccurate meter may be altered either by varying the brake field or by adjusting the shunt of the meter. When it is intended that the former operation is to be the normal one, means should be provided for carrying out this adjustment conveniently, and with some degree of fineness. The magnetic shunt fitted to the modern Ferranti continuous-current meter is as good a device of this kind as could be desired, and with it small adjustments can be made with great nicety. In those cases, however, where no provision is made for giving a small movement to the controlling magnets, and this has to be done more or less by guesswork, the adjustment of the meter may be very difficult. The method of altering the speed of a meter by varying the resistance in the shunt is troublesome if a connection has to be unsoldered; if, however, a number of shunts of different resistance are provided, and these can be easily changed, the method is quite convenient. As with the change wheels, these shunts should be clearly marked, in order that their relative resistances may be known. The method of adjusting a meter by varying the resistance of its shunt is open to the objection that since the normal tendency of a meter is to get fast, each calibration decreases its full-load torque.

In many meters accurate revolution tests are very difficult to take quickly, through a difficulty in seeing the moving element. In the 1910 type British Thomson-Houston mercury meter it was almost impossible even to see if the meter were moving if fixed in a bad light. It would be a great convenience to have a somewhat more definite mark than the dab of paint that is customarily seen, and also to have a corresponding fixed reference mark on the stationary part of the meter. With the slow speed now found with mercury motor meters, the time taken for one revolution of the moving element on the lowest load tested is sometimes as much as one minute. In most meters the part of this element used for purposes of observation is small in diameter, and an error of 5° in estimating one revolution is not improbable, in spite of great care, with the resources provided. Consequently the time required for revolution tests at low loads is inconveniently great. With two fine marks provided, the one fixed and the other attached to the revolving part, this probable error would be much diminished. It may be mentioned that even with two marks there is still a liability of error through parallax. If a third mark, arranged to be in line with the first two when the armature was in the position for commencing a test, were provided, the possibility of error through parallax would be eliminated. The fixed mark referred to above is provided in the British Thomson-Houston Co.'s mercury motor meter, but its utility is considerably impaired by the difficulty experienced in seeing the moving element.

The provision of a hinged front cover to a meter is not always practicable, but, where possible, it is a great convenience when adjusting the meter for inaccuracy. If the meter happens to be a tiresome one to calibrate, the amount of time wasted in taking off the cover for adjustment, and in putting it on for the tests, is quite considerable. The testing constant of a meter might always be marked in a position where it can be seen without removing the cover. This is, perhaps, not of much importance when meters are tested in the test room, but it is a great convenience in the case of a test *in situ*. In some meters it is a matter of difficulty to put a new glass in the window. The breaking of meter glasses is by no means an uncommon occurrence in shops, and it should be possible to replace these easily and quickly. Meter glasses should not he held in position by means of tiny clamps and screws, as the replacement of a glass is awkward in such a place as a dark cellar. If slips of metal soldered on to the case are used, the meter has to be brought in—an otherwise unnecessary proceeding. Windows in meter cases requiring round glasses should be avoided, as in some parts it is difficult to get the glass satisfactorily cut to this shape. Provision for sealing is, of course, found in all meters, but this is a point to which further consideration might, in many cases, be given. Every screw used in fixing the cover of the meter should be sealed, and if the meter cover is secured by four screws, either four seals have to be used, or the method of passing a wire right round the meter has to be resorted to. This last is a very unsatisfactory way, as it takes a long time, and if the case screws are unfavourably placed, is very difficult to accomplish should the case of the meter have to be sealed *in situ*. Two screws should be sufficient to fix the front cover of a meter, and unless these are well to the front, a drilled lug should be provided near each. Frequently meters have to be fixed in damp situations, and it then becomes important that a good air-tight joint be made between the cover and the case of the meter. When, as with some meters, small brass screws are used to secure the cover, this cannot well be done. These screws should consequently be of ample size, so that the cover can safely be screwed up very tight when this is desirable.

The various and minor defects set out above do not affect the theoretical goodness, or the ideal performance of a meter, but they may be productive of troubles more or less serious. If a meter with a small and badly-arranged dial is read wrongly, it is, of course, primarily the fault of the meter reader, but it is none the less a fact that had the dial been properly designed, as it is in some meters, such a mistake would not have occurred. Difficulties in testing meters can be greatly multiplied by minor and apparently insignificant defects in design. In some cases these defects would appear to be the result of pure oversight. In the case, for instance, of a watt-hour meter of otherwise great excellence, and which now enjoys considerable popularity, the hole through which mercury is introduced into the bath is under, and quite close to, the brake disk, and the use of a funnel of special design is thereby necessitated. In this same meter, moreover, it is necessary to remove the counter in order to adjust the brake magnets. Such minor defects as these, so far from being rare, are far commoner than they ought to be. The problem of the construction of a meter that will register accurately over long periods, and that is cheap, has been successfully solved by a number of meter manufacturers, and it would now seem desirable that more attention be given to the correction of defects in detail.

Rand Industries.—A fact worth pondering by those who manufacture mining machinery and electrical and other appliances in this country is that, in six months alone in 1911, the famous Witwatersrand Gold Fields, in South Africa, imported machinery and stores to the tune of £14,070,291. Special reference to this matter and much other information affecting the Rand gold industry will appear in the twenty-first birthday number of the *South African Mining Journal*, which will be published in Johannesburg early in June. The chemical, mining and metallurgical progress and problems of the great South African gold fields will be reviewed by experts; whilst local engineering in all its phases—electricity, steam and air power—will receive special treatment. The question of transportation as it affects the inland industrial centres will be exhaustively dealt with.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Want of Co-operation in Pushing Electricity.

The question as to whether or not it is worth while pushing the sale of electric heaters is one which has for long exercised the mind of every up-to-date and enterprising electrical contractor. It is recognised by those who are in touch with the latest developments in the design and manufacture of electric cookers, &c., that there is no justification for the old complaint that electric heating and cooking apparatus is inefficient and unreliable, and it is further agreed that the demand for the latest cookers, toasters, grills, &c., has increased marvellously during the last few years. That the opportunity for handling this remunerative business has not been seized to a greater extent by the electrical contracting fraternity is a matter for universal regret. On all sides we hear of the rejuvenated and invigorated gas apparatus manufacturer who realises that times are changing, and that if he is to retain his business, and meet the competition of the electric cooker, he must be up and doing, hence we find him flooding the daily Press with his well-written advertisements, urging upon the unsuspecting public the necessity of installing gas geysers, gas cookers, &c.

It seems to me that now is the time for the electrical contractors, electrical manufacturers and electric supply authorities to come together with a view to uniting their efforts in fighting the gas bogey, in educating the public to the many advantages possessed by the electric cooker, and in giving a fillip to the domestic electric load, which seems to be so badly needed, and for which the supply companies are so well prepared at the present time. The lack of co-operation among the various sections of the electrical industry has been deplored again and again, and yet no definite steps seem to have been taken to put matters on a better footing. Surely it is time we realised our responsibilities. It seems to me that we are simply playing at it, and that if we are not to be hopelessly out of it so far as good cooking and heating business is concerned, we must really mend our ways. Now, it is certainly the case that with one or two exceptions, electrical contractors do not trouble themselves about electric cookers and the like, and, perhaps, they have a good reason for their apathy. They may be dissatisfied with the manufacturers or the supply authorities, or, indeed, with both. I have been told that the supply authorities are in some cases inclined to pooh-pooh the efforts of the contractors, and are out of sympathy with them. If this is the case, I can quite understand that the contractor does not bother himself.

Now, my proposition is this: Why should not the Electrical Contractors' Association, the Municipal Electrical Association, and the British Electrical Manufacturers' Association, call a joint meeting of their members in order to discuss this question? Or better, perhaps, let each body appoint a small Committee to represent its views on the larger Committee. Let the representatives meet and consider this matter fully, and from every point of view. Let all difficulties and complaints be voiced, and I am sure that the results can only be for the mutual good of the interested parties.

Do you think that Mr. Walker, of the Electric Supply Publicity Committee, would be prepared to take the initiative in this matter?

Warwickshire.

On Advertising Electricity.

I have been interested in the remarks of Mr. C. P. Sparks, at the last meeting of the Institution of Electrical Engineers, in the discussion of the means of increasing the use of electricity for domestic purposes. Mr. Sparks, among others, states that he does not believe in newspaper advertising, holding the view that the only proper method of publicity is demonstration in showrooms and by personal canvassing.

Why does Mr. Sparks narrow his business development work to the showroom? Showrooms are only one form of advertising, and it goes without saying that they are necessary, just as a shop is necessary to a merchant.

Central station companies need to employ not one, but all the established and effective advertising and business developing methods, the use of not only showrooms and canvassing, but demonstrations, exhibitions, circularising and the free use of newspaper space.

To state one's disbelief in the efficacy of newspaper advertising is to shut one's eyes to evident facts. If anything has been established clearly it is that daily newspaper space is one of the most effective means of creating a demand from the general public. Central stations should use *every* recognised means of advertising their wares, and not confine themselves to one or another form of advertising. Most of the criticism which has been levelled at the Electric Supply Publicity Committee has been on the score that their advertising work has been confined too much to one form, viz., the use of circulars, and too little attention has been given to the use of newspaper space and other advertising methods.

It would perhaps clear the situation if those who think like Mr. Sparks were to arrive at a proper understanding of what advertising really means. Advertising has been aptly defined by someone as "changing the mental attitude." Now, that is what is needed in the case of electricity supply—the "mental attitude" of the public towards electricity must be changed—the ignorance that exists must be corrected, and people must be taught to understand and appreciate the safety, convenience, and numerous other advantages of electric service and appliances; also that electricity is not a luxury, and, all things considered, is as cheap or cheaper than other forms of light and power.

Now, the advertising must be made effective, and to this end advertisements must be ably prepared, tellingly conceived, illustrated and worded. The services, therefore, of an advertising expert are needed, and electric supply companies should take a leaf from the practice of the most aggressive and successful of the national business firms, all of whom have an advertising department in charge of an able advertising man.

Material progress will be made when the English companies and supply authorities cease to treat central station work as simply an engineering profession and recognise it for what it really is—a commercial business proposition. A lot of the false pride and mistaken objections that exist today in regard to advertising and the use of commercial methods would then disappear, and give way to honest acceptance of good business-getting methods.

F. W. Willcox.

London, E.C., *May 1st*, 1912.

The Domestic Load.

On page 669 of your current issue I find Mr. Howard Foulds deploring the attitude of the British Electrical and Allied Manufacturers' Association in recommending its members not to countenance the proposed Exhibition in Birmingham. On page 673 in your notice of the "Ideal Home" Exhibition you rightly comment on the inadequate representation of the electrical industry at Olympia. On page 693 Mr. R. Borlase Matthews slates the electric supply station and the contractor for their inefficiency in salesmanship, and gives it out that the Supply Undertakings Committee is only playing at the business of publicity, and again on page 698 in the discussion on the recent paper on "Domestic Electricity," I find Mr. Seabrook lamenting the ignorance displayed by electrical men in pushing the electric supply business and referring to the rubbish which is spoken and written on the subject.

Now, sir, what does all this mean? It seems to me, an onlooker, that the above views are amply justified. There is an immense field for the sale of electric heating and cooking apparatus, and yet the business done is practically *nil*. We seem to be all at sixes and sevens on the question of sales organisation. Every section of the industry is more or less following its own bent, and the result is chaos and negligible returns. Is there no remedy for this state of affairs? Why should the manufacturers not assist Mr. Foulds with his Exhibition? Are they so blind to their

own interests that they do not think it worth while exhibiting, or is it a question of expense? Perhaps the fault is on the other side, and it may be that supply authorities in general are not taking their fair share of the work and expense of publicity. It would seem so, judging from the above extracts.

It is quite clear that co-operation is badly needed. We must all pull in the same direction. Let us study the gas people and their ways. If we do not take some steps soon to meet the competition of our prosperous friends, we shall be lost altogether.

The opportunity is with us now. If we allow it to pass, we may as well give up the idea of ever successfully handling the domestic cooking and heating load.

Onlooker.

May 1st, 1912.

Midland Electrical Exhibition.

I am sorry to see, from your correspondence columns, that my old friend Foulds is labouring under a sense of injury in connection with the action of the B.E.A.M.A. and the Midland Exhibition. Mr. Foulds says that "a serious error of judgment has been committed," with which I agree, and since he has put his case before your readers, I am compelled to put that of the Manufacturers' Association, in order that those readers may have an opportunity of judging where the error lies; on the part of Mr. Foulds, or on the 15 leading manufacturers who form the Council of the Association.

First, let me dispel what seems to be a wrong impression in the mind of Mr. Foulds. He writes of the Association having "declined to allow the manufacturers to exhibit." The Association is not a separate entity with authority over the manufacturers. The Association *is* the manufacturers, and any expression of the Association is the wish of the manufacturers. It cannot be otherwise. I will not venture to burden your columns with all the contradictions which Mr. Foulds' letter seems to call for, line by line. Suffice it that the only offer the Association made was to co-operate in exhibiting such apparatus as would appeal to the general public. The Council, at an interview, were informed by Mr. Foulds that that was insufficient, as what was contemplated was an exhibition "substantially on the lines of the Olympia Exhibition." Anyone pausing to consider what the Olympia Exhibition cost the manufacturers, both in money and interruption of ordinary work at a very busy time, will, I am sure, understand that they cannot undertake such labour and expense oftener than is necessitated by the usual triennial exhibition. That such an exhibition was not only contemplated in Birmingham, but actually planned and arranged for, without any reference whatever to the Manufacturers' Association, and now has to be abandoned owing to the inability of the manufacturers to do that which was taken for granted, is, I think, sufficient evidence of where the error of judgment lies. The only promises made by one or two individual manufacturers to exhibit were contingent upon other manufacturers doing likewise, and the fact that the great majority had no wish to exhibit is only another proof of the utility of the Association.

It has been a matter of very great regret to the Council of the Association that anything having the appearance of a disagreement should have arisen with the authorities of such a centre as Birmingham, and I can only express the personal hope that, in due course, such an Exhibition may be held in that city as will be a credit both to the local authorities and the manufacturers and a benefit to the electrical industry.

A. Bruce Anderson,
Chairman of Council, B.E.A.M.A

Hollinwood, *April 29th*, 1912.

The Education of the Engineer.

Having had occasion to peruse Mr. J. F. C. Snell's valuable treatise on "Power House Design," I beg to draw attention to one or two points in connection with the publication of the work, which, perhaps, will to some extent tend to militate against its value as a reliable source of information for those engineers connected with station work, who may refer to it for guidance.

Errors of any description in an up-to-date technical book are, of course, regrettable; but when such errors are largely typographical, and have, no doubt, crept in during the publication of the work, it is all the more regrettable, and especially so in the case of a rather expensive volume on such an important engineering subject.

Probably a large number of the errors will be observed at first sight—as for example, "252 periods," where, no doubt, 25 periods is intended by the author; but in the chapter dealing with small power houses and sub-stations, I notice that the annual efficiency of the L.C.C. tramways sub-stations is given as 73·5 per cent. for the synchronous sets and 82·1 per cent. for the asynchronous motor-generator sub-stations.

Possibly these figures have been misplaced in the present edition, as, from experience in one of the largest Corporation undertakings, my opinions have been confirmed with regard to the higher all-round efficiency (usually from 7 to 10 per cent.) of synchronous sub-station machinery as compared with asynchronous, and the difference in this case of 8·6 per cent. is probably in favour of the former type of converting plant.

Those engineers who are conversant with Mr. C. H. Wordingham's excellent treatise on "Central Electrical Stations," cannot fail to appreciate the value of careful supervision during the publication of an important technical book, and it is to be hoped that the publishers of "Power House Design" will take an early opportunity of issuing an errata sheet for the present edition, or else take other steps to render Mr. Snell's important work of the highest possible value to those for whom it is specially intended.

L. Marshall Jockel.

Middlesbrough, *April 30th*, 1912.

The I.E.E. Students and the New Articles.

It is a matter for regret that the only note of protest against the revised alterations of the Articles of Association of the I.E.E. should emanate from one of the Student Section. Mr. H. Douglas Steers's ill-timed protest is written without cognisance of the facts, and apparently his interest in Institution affairs has not been large enough to create the desire to ascertain them.

As long ago as last November, when the Local Sections and independent members made their protests, Students also respectfully protested, as Mr. Steers will note if he refers to the electrical Press of that period.

The Council have shown the utmost consideration and sympathy in dealing with the Student Section, and it may interest Mr. Steers to know that, when Members of the Council visited and conferred with the Local Sections, Messrs. Hammond and Rowell received a deputation of five Manchester Students, with whom they discussed at considerable length the views of the Manchester Student Section. Further, Professor S. P. Thompson and Mr. J. F. C. Snell have in particular watched the interests of the Students.

If Mr. Steers will compare Articles 13, 16, 17, 26 and 27 as proposed in November and as now finally revised, he must admit that the Student point of view has been considered to no small extent; and if he will carefully read these Articles he will also admit that Students have no ground for complaint as far as the Articles go.

I can assure Mr. Steers that many other ideals of the Student Section, including the printing of their papers, are receiving the sympathetic consideration of the Council.

Adolf R. Stelling, *Stud. I.E.E.*

Manchester, *May 5th*, 1912.

We are hearing a lot just now about the status of the Institution of Electrical Engineers and the new rules that are being introduced to improve the same. What about the status of the members of the I.E.E.? To instance the case as applied to central stations. Would not the I.E.E. be a real staff for central station engineers to lean upon, if the code of honour of its members forbade central station managers from employing side by side with men of training and years of experience, totally inexperienced men as switch-

board attendants, charge engineers, &c., or forbade the paying of such miserable pittances as 10s. to 25s. for 56 hours per every week in the year, of day and night, Sunday, Saturday, Bank Holiday and every day of strain and endurance, under the guise of gaining experience?

Also some regulations are required with regard to the pupil evil.

It appears to me that it is not new rules that are so badly wanted as a code of honour, or unwritten or written law amongst the members.

One has only to glance down the "Situations Vacant" column of this journal to satisfy himself of the veracity of these facts and failings.

Might not at this time some thought be given to the "Students," who are to supply the future members, not as in the present new rules discussion, total and absolute disregard of their very existence?

Struggling Stud. Inst.E.E.

May 6th, 1912.

Warning to Inventors and Patentees.

I have had considerable trouble with electrical firms who receive models of Patent apparatus on trial ostensibly with a view to taking up the manufacture, but really with the idea that as long as the patentee thinks they are considering it he will place any orders that he may have control of with them to "oil the wheels." Then after wasting about six months, and a lot of letter paper, they say that their works have so much in hand that they reluctantly feel that they must drop all idea of proceeding in the matter or they make some equally useful excuse, and the model is generally returned badly packed and in a derelict condition, showing that it has simply been laid aside.

What I intend to do in future is to avoid, as far as possible, the placing of orders with firms who have a patent of mine under consideration, and I hope brother inventors will do ditto.

Arch. J. Howard,
Borough Electrical Engineer, Taunton.

May 6th, 1912.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

Interest has recently been manifested in oil-shale deposits in Canada and it is not at all improbable that such deposits may be made use of for power purposes in time.

Peat has already been mentioned in these notes and, owing to the publicity given to the subject by the Department of Mines and the Commission of Conservation and the efforts of the recently formed Canadian Peat Society, it is attracting attention. This country has already had one experience of a coal strike in the States seriously affecting its supply, and the recent trouble in England combined with the threatened serious strike in America, are likely to make Canadians take the question of the utilisation of peat as fuel into careful consideration. The coal used in the Dominion last year consisted of 9·8 million tons mined here and 14·6 million tons imported from the States, so it is quite evident that the effect of a strike in the latter country might be to create a very awkward position in the former.

The Commission of Conservation has issued a pamphlet dealing with the subject of an application by the city of Chicago for permission to increase the flow of water from Lake Michigan to the Mississippi River. As the ostensible object for which the water is required is that of dealing with the sewage effluent, the subject does not at first appear to have much interest for electrical engineers, but the pamphlet referred to points out that, besides seriously affecting navigation and the great lakes by appreciably lowering their levels, a good deal of water-power will be diverted to, and probably made use of by, Chicago; and what is more, the same water if allowed to flow over Niagara Falls as it does at present, instead of being utilised at Lockport, Illinois, could generate five to seven times more power than at the latter place.

The Commission expresses its "unqualified disapproval" of the scheme.

The Canadian Northern Railway is reported to be trying a new gas-electric car, the cost of operation of which works out to something like 18 or 20 cents per car mile, which compares very favourably with that of ordinary electric trams, so that similar cars could be used instead of trams for outlying districts, &c.

An order for 20 cars built entirely of steel, except the door and window frames, has recently been placed by the Ottawa Electric Street Railway Co.

AUSTRALIAN TRAMWAY COMPANIES AND THEIR EMPLOYÉS.—III.

The hearing of the arbitration case, brought by the Australian Tramway Employés' Association against eleven of the principal Tramway Authorities in Australia, was continued before the Federal Arbitration Court at Melbourne on Thursday, March 7th. The claims made by the Association were summarised in our last issue.

The evidence of Mr. G. L. Prendergast, the president of the Association, was continued. He said that the policy of the Association was to gain their object without striking, and that both at Brisbane and Adelaide they had used their influence towards peace. He had been a builder's clerk, and commenced to agitate for better conditions of employment soon after he joined the Prahran-Malvern Tramway Co. as a conductor. As tramway workers they objected to long hours and the manner in which occasional labour was engaged. A number of other minor grievances were detailed.

The next day was largely devoted to questions as to the manner in which the statement of claim was prepared, and whether it had in reality been carefully considered by the various branches of the Association. At Malvern, it was stated, the conductors' wages at present were 48s. per week, and motormen's 48s. to 50s., with a bonus on current-saving; it was also stated that although some of the motormen made 6s. to 7s. 6d. per week bonus, yet the Association objected to it. Asked why, it was stated that the bonus system encouraged men to break the company's regulations and run by passengers in order to save the current consumed on re-starting.

Mr. Prendergast stated that the men had decided to withdraw their claim for an extra 10 per cent. from the Brisbane Co. The only district in which they now asked extra was Western Australia, where they wanted 15 per cent. over the other normal rates. He intended to call witnesses from each State to show that dissatisfaction did exist, although in some cases it had not been brought to the notice of the management.

Mr. Champ, the secretary of the Queensland branch of the Association, dealt with the position of affairs at Brisbane. Many of these have already been stated. The Company was decidedly averse to the formation of any union outside its own employés, and started one of its own. This had about 80 members, as against 450 in the other. A bad feeling was created, and every act of the company was criticised. Instances were given, and reserved for further evidence, where it seemed as if men had been penalised, by dismissal for minor offences, for being members of the larger union.

Mr. G. Bryant, the secretary of the Hobart branch, resumed his evidence. Out of 105 employés, about 70 were unionists. Complaints were made of hours and wages, and that conductors were responsible for lost tickets or for tickets advanced to passengers on credit. It was also stated that time was reckoned as starting from when the car reached the Post Office, 400 yards away from the depôt, so that the motormen had to give about a quarter of an hour on going on duty, and the same at night. Again, there was a break of three hours, 2 a.m. to 5 a.m., in the night shift, which free time was perfectly useless to the men.

It was pointed out by the Judge that many of these matters seemed capable of adjustment by a conference between the parties, and a suggestion was made that the manager should meet the men. Mr. Parker, the manager, asked for time to consider this proposal.

Mr. Hill, secretary of the South Australian branch, gave evidence of the condition of affairs at Adelaide. This branch had drawn up a demand for 12s. per day for motormen and 11s. per day for conductors, but they had subsequently adopted the Association's proposal for 11s. per day for both motormen and conductors. At the end of November the minimum rate paid by the company was raised to 8s. per day. The men were dissatisfied with wages, hours, overtime rates, and other matters. Conductors had to make up shortages, but were not given the benefit of moneys overpaid. As justification for their demand for higher wages, they stated that in South Australia builders' labourers received 12s. per day, boilermakers' labourers and blacksmiths' strikers 9s. a day, and pick-and-shovel men on tramway construction works 9s. a day; members of the Amalgamated Society of Engineers received as a minimum 12s. a day. Further evidence of the cost of living was given. It was stated that out of 700 employés at Adelaide, 257 had left during 2½ years. About 500 members belonged to the Association, but the tramway company refused to recognise them.

Mr. O'Connor, the president of the Victorian branch of the Association, detailed his experiences as an employé for 12 years, during which time he had been twice dismissed and reinstated—once after the matter had been mentioned in the Legislative Assembly. Amongst other points, he demanded the Appeal Board, to which all disputes between employer and employé as to discipline could be referred.

The Judge pointed out that he was open to conviction, but at present he thought the claim an extravagant one.

The Association, through Mr. Prendergast, then asked for the production of the company's books relating to all cases of discipline, to show that favouritism existed; and, after discussion, it was decided that books, other than financial books, relevant to the case for the past two years should be produced.

Mr. O'Connor complained of having to collect 80 fares in three minutes and being held responsible for ticket shortages, having to have tea on the car, and having at times to work with inexperienced gripmen. He also claimed that tramway work was very unhealthy, and that this should be taken into account in fixing wages.

Mr. Ovenden, an Adelaide motorman, complained that a motorman was once fined £2 2s. for damage done to a car in collision, and a conductor had been fined for declining to work more than nine hours a day. A conductor had to know every street on his route, and till he knew them the motorman had more work to do. Motormen had also a number of forms to make out, and, in fact, he had to be a person having more knowledge than he was generally credited with. The men wanted higher pay and shorter hours, and asked for promotion by seniority.

The Judge pointed out that this method prevented merit from receiving its due reward.

Another claim was that the men should be paid for the time spent in attending ambulance lectures.

After several other similar complaints had been ventilated, the Court adjourned for a period of 11 days.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

A New Design of Travelling Crane.

An electric travelling crane of improved design is shown in the accompanying illustrations. This crane was designed by MESSRS. SMITH, MAJOR & STEVENS, LTD., of Abbey Works, Northampton, as the result of their failure to obtain exactly what they wanted in the open market when they were equipping their new factory at Northampton, and they evolved this design, two examples of which are now working in their shop with success. The points aimed at in the design were simplicity consistent with high efficiency and convenient control, together with more ample proportions of the smaller parts than are usually to be found in the standard types of cranes of this size that are at the present day on the market. The first figure shows the general appearance of the crane, which is designed to lift three tons and has a full-load lifting speed of 27 ft. per minute, while the longitudinal traverse has a speed of 233 ft. per minute, and the cross traverse can run up to 80 ft. per minute. The motors are all series-wound, the lifting motor having a capacity of 9 B.H.P. at 400 R.P.M. The longitudinal traverse motor is a 5-B.H.P. one, running at 500 R.P.M., and the cross traverse is operated by a 1½-B.H.P. motor running at 440 R.P.M. These motors are controlled by means of liquid starters arranged in the cab and conveniently placed for the use of the operator, while the lifting motor is controlled by an electric brake of the type which Messrs. Smith, Major & Stevens have used with success on their standard lifting gear. The drum and bands are of the multi-grooved type, the drum being constructed of cast-iron and the bands of gun-metal. The longitudinal traverse is controlled by an ordinary band brake foot-operated from the cab. The span of the gantry is 28 ft., the cross travel of the hook 22 ft., and the effective lifting travel of the hook 17 ft. Fig. 2 shows clearly, fixed to the side of the traveller, the special knock-off switch which is provided in order to guard against the possibility of overwinding, this switch operating automatically when the safe limits of lift are exceeded. It will be seen that a very light and yet strong type of electric crane has been evolved by this firm, which appears to possess merits which make it of considerable practical interest. The first illustration also shows the general lay-out of one of the important departments in the new shops at Northampton.

FIG. 1.—NEW ELECTRIC CRANE.

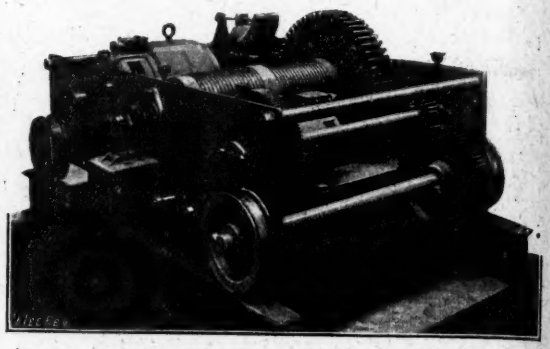

FIG. 2.—CRAB OF ELECTRIC CRANE.

"Efesca" Electric Grill.

In the new catalogue issued by MESSRS. FALK, STADELMANN AND CO., LTD., 83 and 87, Farringdon Road, London, E.C., there are several serviceable lines of electric heating and cooking apparatus. A hot-plate cooking range with polished mouldings, made in cast-iron, contains two 7-in. boiling plates, and measures over all 24 in. × 12 in. It gives ample space for a number of saucepans, three of which can be kept boiling over each plate. Each hot plate is controlled by a switch fixed on the front, and a suitable oven can be placed over either for cooking small joints. Another feature is a breakfast cooker in black enamel finish, with polished-steel top plate and facings. It comprises one 6-in. boiling plate with two heat regulations, and a grill 9 in. × 9 in., the top of which can also be used for boiling. Another line is that illustrated in fig. 3, which shows a nickel-plated grill and hot cupboard made in sheet metal 19 in. wide × 13 in. deep × 19 in. high.

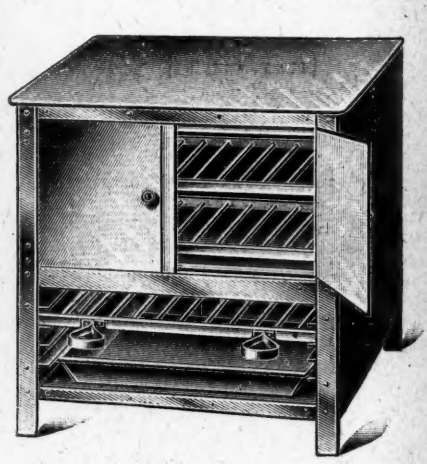

FIG. 3.—"EFESCA" ELECTRIC GRILL.

Automatic Solenoid Starter.

THE ELECTRICAL APPARATUS CO., LTD., of Vauxhall Works, South Lambeth Road, S.W., have brought out a new automatic solenoid starter, which has the novel feature that one solenoid operates two separate plungers, one at each end. The one at the top controls the main switch. This has a double break, and is fitted with laminated contact brushes and carbon arcing tips.

The operation is as follows:—On the solenoid being energised, by means of a push button or otherwise, the top plunger immediately acts, closing the main switch, and starting the motor with all the resistance in circuit. The bottom plunger then comes up at a rate regulated by the dashpot, causing the lower switch gradually to cut out the resistance till full speed is attained.

On the solenoid being de-energised, the top plunger at once rises, opening the main switch. At the same time the bottom plunger

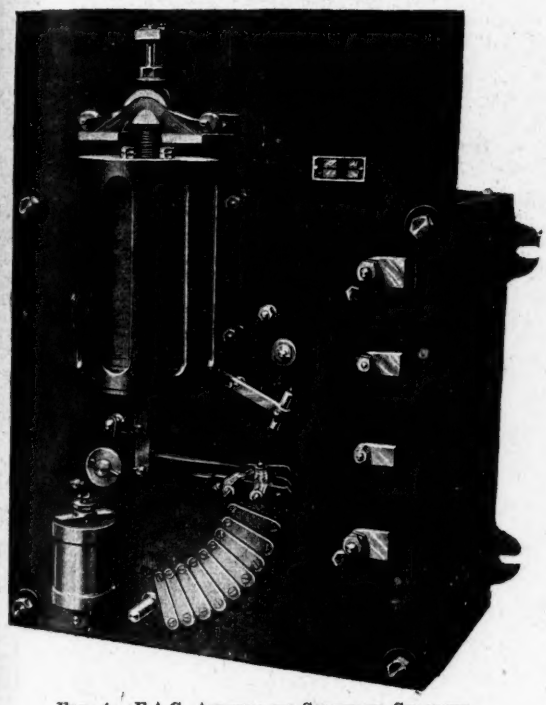

FIG. 4.—E.A.C. AUTOMATIC SOLENOID STARTER.

falls to its lowest position, ready for another start. The switch that controls the resistance has no "off" position, so that the circuits cannot be broken on the sliding contacts.

This starter has been specially designed for inching, such as is required in printing press control. There is no shock or noise when the plungers operate, and a double break is provided on the main switch. The use of a single solenoid for the two switches makes the starter more reliable, more compact, and less expensive than old types.

The "Mumps" Lampholder.

We have received from MESSRS. G. ST. JOHN DAY & CO., of Mumps Electrical Works, Oldham, a sample of their "Mumps" lampholder, a patent for which is, we understand, pending. This holder possesses features of its own, and is well worth inspection.

The interior consists of two cylindrical porcelain blocks, the upper one fitting into a recess in the lower one, and held in position by the screwing-up of the plunger contacts. The upper block is

FIG. 5.—THE "MUMPS" LAMPHOLDER

made with a porcelain bridge, which effectively separates the wires at the point of entry; the wires pass down through holes and are secured to small brass terminals on the under side. The terminal screws are double-ended, and the long projecting ends are inserted into the lower porcelain block, the plunger contacts fitting into recesses in the opposite or lower side, and being screwed on to the ends. It may be noted that in fastening the two blocks together the flexible is securely gripped between the two; moreover, the unscrewing of the plunger contacts releases the wiring parts. The two porcelains fit into a thick-gauge brass barrel, the lower end having the bayonet sockets formed in it, while an adjusting nipple screws over the upper end, and a locking ring is screwed down inside on to the porcelains, fixing them in position and, if screwed down far enough, locking the lamp in position.

The device is solidly constructed to the Home Office specification, and its simplicity and other good features should appeal to electrical men generally.

New Inspection Tee.

Special forms of inspection tee are now being introduced by MESSRS. SIMPLEX CONDUITS, LTD., for installations where the tubing is run under the floor boards and laid across the joists, with a short drop to the ceiling rose or light point in the room below. These tees are made somewhat smaller than the standard circular boxes, thereby effecting some saving in cost, and at the same time providing for a convenient inspection opening, from which the

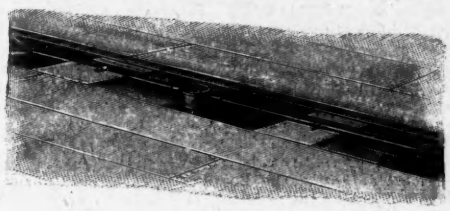

FIG. 6.—SIMPLEX INSPECTION TEE

wires may be threaded or pulled into the tubes. They are sufficiently large to allow of a joint being made between small wires also. The tee piece is provided with a spring-in lid.

The illustration shows the method of application in practice, looking from the floor above the room in which the light point is fixed, the tubing being let into the joists and fixed with an ordinary crampet. It may be pointed out that care should be exercised in cutting "ways" in joists for the conduit to lie in; only a small factor of safety in the strength of joist is allowed for, and this is seriously reduced if too much cutting-away is done in erecting the conduit.

PARLIAMENTARY.

Light Railways Bill.

SIR A. BOSCAWEN presided on April 30th over Standing Committee B, which commenced the consideration of the Light Railways Bill promoted by the Board of Trade, which is a Bill "to continue and amend the Light Railways Act, 1896."

Clause 1 was as follows:—"(1) If any order under the Light Railway Act, 1896 (in this Act referred to as the principal Act), is not confirmed by the Board of Trade on the ground that the proposals of the promoters ought to be submitted to Parliament in pursuance of Sub.-Sec. (3) of Sec. 9 of the principal Act, the Board may, if they think fit, submit the proposals to Parliament by bringing in a Bill for the confirmation of the Order. (2) If while a Bill confirming any such Order is pending in either House of Parliament, a petition is presented against the Order, the Bill so far as it relates to the Order may be referred to a Select Committee, or, if the two Houses of Parliament think fit so to order, to a Joint Committee of both Houses, and the petitioner shall be allowed to appear and oppose as in the case of Private Bills. (3) In bringing in a Bill under this section for the confirmation of an Order, the Board of Trade shall make a special report to Parliament with respect to the Order."

MR. HICKS-BEACH asked that the Minister in charge of the Bill should give them some explanation of its objects; so far as he could gather from Clause 1 it would seem that there were difficulties under the present procedure.

MR. WARDLE asked if the Government was to pay the whole of the expenses of the Bill. If it was of benefit to a private promoter, why should he not pay?

MR. J. M. ROBERTSON (Parliamentary Secretary to the Board of Trade), in reply, said some difficulty had actually been found in regard to the form of procedure. The Light Railways Act had not done all that was expected of it, but it had done enough to make it highly desirable that the facilities for light railways should be further extended if they could do so by means of an amendment of the law. There had been two or three cases in which schemes had been brought forward which the Board of Trade entirely approved of, and which would have been beneficial to the districts concerned; but when the promoters found that they were called on to begin again, and bring forward a Bill in Parliament, they dropped the schemes, and they had never been revived. They were discouraged by the trouble and expense which the method of procedure put

upon them. The effect of this clause was to provide that in any future cases of that kind when a scheme was brought forward which the Board of Trade approved of, but which was important enough to require the consent of Parliament, then, instead of the promoters having to incur the expense and trouble, the Board of Trade would practically do the work for them, and schedule the Bills in one Order. The defence of such a Bill before the House would lie with the promoters, but by this new procedure they would be saved so much trouble and expense that the Board of Trade felt that such schemes as had fallen through under the old procedure would be enabled to go on, and thus the construction of light railways in general would receive useful encouragement without any such abuse as Mr. Wardle expected might arise.

MR. WARDLE asked if it would be the same as an ordinary Bill going before a Committee.

MR. ROBERTSON said the defence could lie with the promoters. It was not a case in which the Board of Trade would incur the cost.

MR. J. SAMUEL pointed out that local authorities ought to be safeguarded. The promoters of a scheme might satisfy the Board of Trade, but the local authority might object. If the Board of Trade took up the case the local authority would be greatly handicapped.

The Hon. H. LAWSON thought the House had hardly any idea of the extent to which the Bill attempted to extend the powers of the Board of Trade. In fact, if the Bill was adopted without amendment it would deprive Parliament and the local authorities of a great deal of the controlling powers they now had. A Bill brought forward under Clause 1 would not follow the ordinary procedure of Private Bill Legislation. No notices, he took it, would be given, and therefore persons and authorities interested would only get such notice as would be convenient to the Board of Trade of what was proposed to be done. He considered this a very serious innovation.

MR. ROBERTSON said that in cases where there was no opposition by the local authority the Board of Trade could call on the promoters to proceed by Bill. Members must not think the Bill was promoted merely to deal with cases where there were disputes between promoters and the local authorities. The cases of good schemes which had been discouraged included the Eardley and Coatbridge scheme, the Dundee and Broughty Ferry scheme and the Staines and Egham scheme. The local authority could first put their case before the Light Railway Commissioners, and then before the Board of Trade, and in the past the Light Railway Commissioners had been accused by promoters of unduly favouring the local authorities. If the Board of Trade did not think a scheme sufficiently important to come before Parliament as a Bill, then, under the existing law, the local authorities could make their views heard before the Light Railway Commissioners. When the Board of Trade called on the promoters to come before Parliament, they relieved them of the expense, but the Board of Trade had no power to turn the local authorities out of Court. The action of the Board of Trade would always be subject to due supervision by Parliament.

MR. LAWSON asked if notices would have to be given before a Bill was introduced.

MR. ROBERTSON said they would. A Bill could not be introduced by any secret procedure.

MR. HICKS-BEACH said it seemed to him that this Bill would be a direct incentive to the promoters of light railways to promote a big scheme, and so force the Board of Trade to submit it to Parliament and pay some of the cost of the promotion.

MR. ROBERTSON said that under the procedure there would be no expense on the Board of Trade at all. The expenses of the Board of Trade would be charged to the promoters, but such expenses would be trifling as compared with the expenses now incurred by the promotion of a private Bill.

Clause 1 was then agreed to.

Clause 2 provides that (1) "A trackless trolley system along any road or street may be authorised by order under the principal Act in the same manner and subject to the same conditions as a light railway, and that Act, and any Act amending the same, shall accordingly be construed as if the expression 'light railway' included a trackless trolley system."

MR. LAWSON moved an amendment to the effect that the clause should read "A trackless trolley system along any road or street may, with the consent of the road authority of the district in which such road or street is situate, be authorised, &c." He said that this clause would enable the whole of the country to be covered by a network of trackless trolleys. The whole of the system by which the tramways had been extended in different parts of the country was reversed by the provisions of this measure. The Board of Trade was enabled practically to take the place of the local authorities and to ignore the policy of Parliament. The trackless trolley system was wholly an experiment, and without going into the merits of it he could say it would be wholly unsightly. It would do enormous damage to the roadways, both in the town and in the country, and at any rate it required, as such, more deliberate consideration than it had yet had before these wide powers were given to a department of the Government. He thought the Board of Trade was much too greedy in this Bill. At present the Borough Councils in London had the right of veto in regard to tramways, but the whole of that right was done away with under the Bill. He could not imagine such a system being applicable to towns at all, for there would be two overhead wires, whilst the roads would be cut up to an extent to which the damage done by omnibuses would be a trifle. At the same time no compensation for damage was to be made by the promoters of the schemes. He did not think it would be difficult to imagine enormous ruts being made in the roads.

MR. HICKS-BEACH said he would support the amendment on behalf of the company. He was not an electrician, and did not really know what a trackless trolley system was. He rather gathered that the vehicles would be something like the enormous pantechnicons which came from London to the country now, and did enormous damage to the roads. He did not conceive that the system would be any good to traders and agriculturists unless they were of fair size, and in that case they must damage the roads, and they certainly ought to pay something towards the maintenance of the roads.

MR. ROBERTSON said the question of the effect of the system on the roads would be discussed later. He would point out that the amendment went much further than anything sanctioned under the Tramways Act of 1872. Under the Tramways Act, two-thirds of the local authorities had to give consent, but the amendment would mean that one authority alone could upset a scheme. Such a veto as this would be a most reactionary thing, and the real rights of the local authorities were abundantly safeguarded. As regarded the effects on roads of trackless trolleys, they had enormously exaggerated the effect. If they were going to run in ruts they had better have a tramway. The vehicle would be lighter than a motor-'bus, as it got its electric power through the trolley and the overhead wire, and did not have to carry machinery as was the case with the omnibus. The weight limit put to the vehicles so far was 5 tons, which was much less than that of the vehicles referred to by Mr. Hicks-Beach. Hon. members were condemning a system which really was carrying out what they wanted.

MR. BIGWOOD said that from inquiries he had made, the damage to the roads of the trackless system was exceedingly light, as compared with motor-'buses. He had received a communication from the Municipal Tramways Association approving of the Bill, as its objects were highly desirable. He also felt that with regard to housing, large municipalities would, by the adoption of this system, be enabled to carry working men to the outskirts. He understood that the Board of Trade had given an undertaking that where a municipality had a well-equipped tramway system no private promoter would be allowed to run over such routes.

MR. ROBERTSON said that no pledge had been given, but obviously there would be no disposition to grant such powers.

MR. BIGWOOD said it seemed to him that local authorities would get something in the shape of increased rateable value from districts developed by the system.

MR. HASLAN pointed out that a tramway had to keep in repair so much of the road, and if these trolley vehicles were going to do damage to the roads, they ought to pay something. At present petrol vehicles did pay something by way of the tax on petrol.

MR. WHEELER argued that if the local authority was to have no veto, what was the good of a local authority being elected by the people? He had in his mind the case where only a single local authority was concerned.

MR. ROBERTSON said that in the case where one local authority only was concerned, the Light Railway Commissioners would give no order.

MR. WHEELER urged that in narrow streets ruts in the road would be bound to be made.

MR. F. GOLDSMITH said that, as a member of the Local Legislation Committee, which had given consideration to several trackless trolley systems, he agreed that they did less damage to the roads than the ordinary motor-'bus, but, at the same time, he would like an assurance that something would be done to satisfy any possible objection of the local authorities. At present in London the Borough Councils had a veto on the overhead system of tramways, but this Bill would do away with that veto. There should be some safeguard put in the Bill. In the country the trolley vehicles would cut up the main roads, and he would like to know whether the cost of improvements could not be thrown on the authority owning the system. These trackless trolleys had only been running in this country about seven months, and 5 tons as the limit of weight was put on by the Board of Trade because it was an experimental system, but there was nothing in the Bill limiting the weight to 5 tons.

MR. LAWSON intimated that he would add the following words to his amendment: "Such consent not to be unreasonably withheld."

MR. ROBERTSON said he could understand the apprehension with regard to the possibility of the amenities of a town being injured by a trackless trolley system, but the common-sense of the Light Railway Commissioners would never admit such a system against the wishes of the inhabitants. He contended that the rights of local authorities were absolutely safeguarded. The limitations of weight to 5 tons per vehicle, and the limitation of speed to 12 miles an hour came from the Board of Trade, which, of its own motion, was imposing these safeguards.

On a division, the amendment was carried by 16 votes to 8.

MR. EDMUND HARVEY then moved that the following words should be inserted at the end of Sub.-Sec. 1 of Clause 2: "Provided that any such order shall contain provisions requiring the company, body, or person upon whom the powers thereof are conferred to pay the cost of any alterations or improvements in the road or street made for the purposes of, or rendered necessary by, the trackless trolley system, and to make a contribution towards the cost of maintaining the road or street, regard being had in determining the amount of such contribution to (amongst other things) the additional expense incurred by the authority by whom the road or street is maintained."

MR. LAWSON seconded the amendment.

MR. ROBERTSON said that whilst members would like to safeguard local authorities, yet the amendment would give the local authority the power to squeeze a particular undertaking. The local authority would be unable to get anything out of the heavy road engines and traction engines, but the promoters of the trackless trolley systems would be mulcted. In view of the decisions of the

Local Legislation Committee, he hoped the amendment would not be carried.

MR. GOLDSMITH said the Local Legislation Committee considered each case on its merits. It was true that the Committee had decided that the Keighley Corporation should not contribute to the maintenance of the roads, but he understood the question would be raised before the House of Lords Committee, and also in the House of Commons. He thought it ought to be made quite clear that a company or a local authority putting down a trackless trolley system for profit ought to pay for the roads, and not the county authority.

MR. HICKS-BEACH urged that it was no argument to say that because certain classes of vehicles did not pay for the upkeep of the roads now, therefore a new system should be allowed which should also be exempt from contributing to the cost.

MR. ROBERTSON said, to meet the wishes of the Committee, he was prepared to accept the following amendment:—

"That an order under this section may provide for a contribution from the applicants of the order towards the cost of maintaining any road or street along which the trackless trolley system is authorised, and in determining the amounts of any such contribution, regard shall be made, amongst other things, to the additional expense which may be caused to the road authority by reason of the order."

MR. LAWSON said this would not apply to the cost of widening of the road except as a point in the maintenance of the road.

MR. BIGWOOD urged that there should be a definite figure placed in the Bill as to the percentage of cost which promoters should pay. He was prepared to move for the insertion of a contribution of 5 per cent. of the total gross receipts.

MR. HARVEY said that, in view of the position they had arrived at, he suggested that they might adjourn so as to have the amendments printed.

On Tuesday, May 7th, VISCOUNT HELMSLEY supported the amendment, as he was of opinion that unless it was carried local authorities would be unfairly mulcted. The local authorities would be called upon to pay very heavy charges for the upkeep of the roads, unless some provision was made for a contribution from the persons who started a trackless trolley system. He denied that supporters of the amendment had any desire to injure this new system, but the ratepayers had to be considered.

MR. J. M. ROBERTSON (who was in charge of the Bill) said he understood that the amendment was moved on behalf of the Association of Municipal Corporations, and he now gathered that it did not altogether meet the wishes of all the members of the Association, as the interests of large and small areas differed. He understood that those who acted for the Association of Municipal Corporations were willing to withdraw the amendment if the Government would accept the amendment which was proposed at the last sitting by Mr. Lawson and carried by the Committee, which was to the effect that the consent of a local authority should be required for any scheme, although the consent was not to be unreasonably withheld. The Government would accept that amendment, but the form of the former would have to be altered on report. Further, he would give the Committee the assurance that the Board of Trade had undoubted powers to insert in any order a provision that the promoters of a trackless trolley system should not only meet the cost of any widening of the roads or anything of that kind which might be necessary, but they also undoubtedly had the power to impose on the new system a contribution towards the upkeep of the roads, and had always exercised their powers with an eye to the interests of the local authorities. In some cases already voluntary arrangements had been made between local authorities and the promoters of the system. He contended that it would be much better to leave the matter to the Light Railway Commission and the Board of Trade, who had full power to protect the local authorities, than to try and lay down any hard-and-fast rule.

MR. GOLDSMITH urged that the amendment should not be withdrawn. He pointed out that trackless trolleys were really in the same position as tramways. The systems would be mostly promoted by Corporations as feeders to their tramways, and it would be very hard that country ratepayers should be called on to contribute to the cost of such systems.

MR. HODGE objected to any tax on means of transit, and considered that the community, as a whole, would benefit by the introduction of the system.

MR. MALCOLM said he strongly objected to any private venture of that kind being made a lucrative concern at the public expense.

MR. HARVEY said the position had been entirely altered by the statement of the Parliamentary Secretary to the Board of Trade, and he asked leave of the Committee to withdraw the amendment.

The HON. HARRY LAWSON protested against any outside body being brought into the matter. They had to adhere to sound lines of legislation, and the real precedent they had to adhere to was the Tramways Act of 1872. Under this Bill they were giving a new franchise of considerable value to a new system of traction.

MR. ROWLAND HUNT moved as an amendment to Mr. Harvey's amendment, the insertion of the following words after "to make a contribution," viz., "of 5 per cent. of the gross receipts towards the cost of maintaining the road or street, to be divided *pro rata* between the local authorities concerned according to mileage."

After some discussion, this was withdrawn. The amendment of Mr. Harvey was subsequently put to the vote, and carried by 19 votes to 16.

VISCOUNT HELMSLEY then moved to add the following words to Paragraph 1 of Clause 2:—"Provided that any such order shall also contain provisions giving the road authority power to control the weight of the cars and to prohibit cars of excessive weight, and that the traffic of such trackless trolley system shall be subject to general regulations made by the road authority."

MR. ROBERTSON expressed himself in full sympathy with the views of the mover and said that later he proposed to move an amendment which would carry out the wishes of the hon. member.

VISCOUNT HELMSLEY thereupon withdrew his amendment.

Paragraph 2 of Clause 2 was next discussed, viz. "The expression 'trackless trolley system' means a system of running on roads or streets without any defined track or line of rails mechanically propelled vehicles moved by electrical power transmitted thereto from some external source, and includes all apparatus necessary for working the system."

MR. HICKS-BEACH moved an amendment to the effect that the clause should read "electrical power transmitted thereto by overhead wires."

MR. ROBERTSON opposed the attempt to alter the definition, although he was prepared to consider any alternative definition before Report stage.

The HON. H. LAWSON ridiculed the draftsmanship of the Board of Trade, inasmuch as "some external source" really meant nothing.

MR. GLYN JONES thought that by the present definition any vehicle which did not manufacture its own electricity would come under the Bill.

MR. ROBERTSON agreed to reconsider carefully the matter of the definition. He did not think an electric brougham which did not generate its own electricity would come under the Bill.

On the understanding that the matter would be reconsidered, the mover withdrew the amendment.

Considerable discussion also took place on Paragraph 3 of Clause 2, and a number of amendments were moved with the object of incorporating several sections of the Motor Car Acts. Two amendments were moved by MR. ROBERTSON, and carried, and when the Committee adjourned the paragraph stood as follows:—"Mechanically-propelled vehicles used for the purpose of any trackless trolley system authorised in pursuance of this section shall not be deemed to be light locomotives within the meaning of the Locomotives on Highways Act, 1896, or the by-laws and regulations made thereunder, nor shall they be deemed to be motor-cars within the meaning of any provisions of the Motor-car Act, 1903, except Sub-Sec. (1) of Sec. 1 of that Act, and the provisions necessary for enforcing that sub-section and subject to that exception, neither that Act nor the regulations made under that Act, nor the enactments mentioned in the Schedule to the Locomotives on Highways Act, 1896, nor the Locomotives Act, 1898, shall apply to any such mechanically-propelled vehicles, except in so far as they are incorporated or applied by the order authorising the system."

VISCOUNT HELMSLEY protested against the hideous complexities of this kind of legislation by reference.

The Committee adjourned till yesterday.

London and North-Western Railway Bill.—This Bill was due to come before Lord Bristol's Committee of the House of Lords on April 30th, but there being no appearance in opposition, the Bill was referred to the Unopposed Bill Committee. The Bill provides, in conjunction with the London Electric Railway Co., for new electric railways from Watford to Euston, and is in connection with the scheme for the electrification of the North London Railway. The promoters have struck out Clause 37 of the Bill, enabling them to supply electrical energy to manufacturers near their railways, and also Clause 36, giving them power to enter into agreements with other railway companies for the generation and transmission of electrical energy for the purposes of those railways.

Canvey Dock and Railway.—Lord Bath's Committee has rejected the Bill for the construction of a deep dock at Canvey Island and of a short railway to Benfleet. The Bill gave power to erect generating stations and to work the railway by electricity.

German Works in Russia.—The Russian A.E.G. Co. of St. Petersburg reports that the volume of business transacted in 1911 was much greater than in the previous year, and notwithstanding the low prices which prevailed owing to competition, the financial results were more favourable than in 1910. After making what is characterised as ample provision for depreciation and reserve funds, the balance of net profits permits of the payment of a dividend of 8 per cent. on capital of £700,000 for 1911, as compared with 7 per cent. in 1910. Large orders are on hand for the new financial year, and important contracts are also expected from the Russian Admiralty. The United Cable Works Co. of St. Petersburg, which is the amalgamated undertaking of the Russian cable departments of the Berlin A.E.G., the Siemens & Halske Co. and the Felten & Guilleaume Co., also experienced an increase in the turnover in 1911, but in consequence of keen competition prices were much depressed, and the financial results were not in proportion to the sales. Including the balance forward, the accounts show net profits of £80,000 for 1911, as against £76,000 in the previous year. The allocation made to the capital redemption fund absorbs £21,000, and the balance allows of the distribution of 8 per cent. on the share capital of £480,000, the same rate as in 1910. The share capital has now been raised to £600,000, by the issue of £120,000, for the purpose of extending the manufacturing plant

LEGAL.

OSRAM LAMP WORKS, LTD., *v.* THE "Z" ELECTRIC LAMP MANUFACTURING CO., LTD.

(*Continued from page* 711.)

THE cross-examination of DR. PASSMORE was continued by MR. TERRELL.

In the patent of 1906 his invention is to take place in the process which is going to operate directly after the baking process, or the carbonising process, and he is going now to retain the reducing gases, that is, to retain them from the specification of 1905, and that is the hydrogen?—Yes.

He says he is going to change the steam into nitrogen. Is that the effect of it?—He is going to have hydrogen and nitrogen instead of steam.

And you say you have proved that it forms cyanogen?—I have proved that it is hydrocyanic acid that is formed there.

Suppose I have a tungsten filament, are nitrogen and hydrogen neutral gases?—Hydrogen will protect the tungsten from the action of oxygen; nitrogen has no action on tungsten.

They are not an indifferent atmosphere to carbon?—Or to tungsten filaments containing carbon.

Supposing you do not care whether you remove the carbon or not, would you treat hydrogen and nitrogen as indifferent gases because you want to sinter; this man is telling you for the first time to sinter?—If I merely want to sinter, and not to affect the composition, I should not use those gases; I would use either one alone, but not both together, because they affect the composition.

The patentee is aiming at getting rid of all the impurities and getting the pure tungsten filament?—It depends on what he calls impurities.

For the purpose of making a filament into a finished filament, is carbon an impurity?—A certain amount of carbon in a filament is not material, the filaments always contain traces of carbon.

If carbon were present in quantities, that would be an impurity?—I do not know.

HIS LORDSHIP: Are you using this as an anticipation of the second invention.

MR. TERRELL: I am using it as an anticipation of the second invention, if that they say the invention is for the use of nitrogen and hydrogen, and that nitrogen and hydrogen remove carbon by forming cyanide. If they say it is limited to the use of ammonia, then we understand where we are, and we can argue it. We say that nitrogen and hydrogen are both indifferent to carbon and to tungsten, and that cyanogen is not formed.

HIS LORDSHIP: That goes to non-utility.

MR. TERRELL: Yes, cyanogen is not formed, and if cyanogen is not formed, then to both carbon and tungsten nitrogen and hydrogen are an indifferent atmosphere, and this is an anticipation, and carbon goes out by volatilisation.

HIS LORDSHIP: At present the witness does not admit that it is an indifferent atmosphere to carbon.

WITNESS: Nitrogen alone is indifferent, but nitrogen and hydrogen act upon carbon.

MR. TERRELL (to Witness): I am going to put to you an experiment that has been tried. A batch of 35,000 filaments of the kind in dispute were squirted, baked, and sintered in the manner adopted at the time of the alleged infringment. The die used was of ·034 mm. diameter—that gives you the size of the filaments. The samples of both baked and sintered filaments were analysed. About 1,080 lamps were made with phospham and about 850 lamps without phospham, the filaments from the lamps also being analysed. The result was as follows:—Carbon in baked filaments, ·804 per cent.; sintered filaments, ·164 per cent.; filaments from the phospham lamp, ·019 per cent.; filaments from non-phospham lamp, ·017 per cent., that being only $\frac{2}{1000}$ of 1 per cent. lower, and, therefore, within the region of error.

Did you make up any lamps without phospham with our filaments?—Yes. We made up lamps with your filaments without phospham and with phospham. We pumped them—exhausted them—by the usual method at the Osram works, not by the method carried out by the "Z" works, and then they were put on the light rack—that is, they were run for so many hours to see whether they blackened at all. I do not know what the last record was, but after they had been running four weeks one was as good as the other, with phospham or without.

Did you estimate the carbon in them?—No, I did not.

Now, I wish to deal with the third patent. This weight referred to is a very tiny little weight, indeed?—It depends on the size of the filament.

In the plaintiffs' factory you have seen the weights put on?—In the laboratory with your apparatus, yes.

What were the sort of hooks you put on?—For these fine filaments a small hook of tungsten metal. I think it weighed about 3 milligrammes.

The weight is put on to the filament before the electric current is put on. Then the current is passed through, and the filament goes through some contortions?—Not with the weight on.

You prevent them happening, and then the filament comes down to a hairpin, and that is done during the process of sintering?—Yes.

You can just as well sinter the filament itself, and then repeat the process, and do it when they are soft a second time, as at first?—No; you do not get the same shape.

I suggest that it does not matter, and it is immaterial in practice whether you put the weight on during the first process of sintering or whether you put it on in the second process, when you also get the benefit, and the full benefit, of the weight on?—I can see considerable difficulty first of all if the weight is not on during the sintering process. At any rate, in the circumstances of a fine filament, it would be nearly all destroyed; and in the second place, having the filaments you cannot get the same shape, and you cannot get such an acute angle.

Re-examined by MR. ASTBURY: Where you get these fine filaments and decarbonise and sinter them in this gas atmosphere which we have been told about, what happens when you start the current on to these fine filaments if they are unweighted and if they are very fine?—They begin to twist and curl. Apparently the decarbonisation is not equal all over, and on one side the strain is more than on the other, and it makes them curl and twist. Very often they touch against the glass or else short-circuit themselves by curling, or touch against the metal support, in either event being destroyed certainly with the apparatus that is used at the Osram works. I should say it would be impossible to make very fine filaments with the apparatus commonly used.

Do you know whether there are specifications prior to 1904 where the making of a homogeneous paste from a metal is described clearly and plainly?—Yes, in many cases amongst those specifications which have been cited as anticipations.

Is our specification of 1904 deficient in telling you how to get at the stage of forcing the thing through the die and getting that which you are going to carbonise and decarbonise?—No, not at all.

Was carbonisation of such filaments as were known a perfectly well-known process in 1904, and was the reason for it appreciated and understood?—Perfectly well known and understood.

Do you know of any difference between the mode in which you carbonise and the mode in which you carbonise and build up osmium filaments, and the result which you get qua carbonisation?—No.

At this stage MR. TERRELL said he thought from his side of the case that it was important his Lordship should see the process at some time or other. If his Lordship went to the defendants' works he could see defendants' process, and also that of the plaintiffs.

The Court was adjourned for half a day to enable his Lordship to visit the works, as arranged.

MR. ASTBURY: After what his Lordship has seen at the works, no doubt we can get along faster. With regard to the decarbonising and sintering before the filaments are put into the globes. During that process, is there any precaution taken at all, such as you see in the carbonising earlier process, to get rid of the hydrogen moisture, or the atmospheric moisture, or the moisture which you say is necessarily in the jar?—The only precaution taken is to insert a small calcium chloride tube in the hydrogen current which would be totally ineffective to dry the large quantity of hydrogen which is being passed rapidly through the tube—calcium chloride being a comparatively weak drying agent.

Could that little bottle or tube of calcium chloride in the sintering process take out any oxygen as distinct from moisture?—No.

How many seconds are the filaments under current during that decarbonising and sintering process in the jars?—It varies with various operators, some are only 20 seconds, others 50.

Having regard to the quantity or percentage of carbon in the filament, was or was not the filament as you observed it during its red state kept sufficiently long in that state for the moisture to decarbonise chemically the carbon in the filament?—Yes.

My friend suggested to you that during the whole of this jar process no carbon monoxide was formed at all?—On the "Z" filaments—no.

Taking the filaments made by the Osram people, have you treated them to an exactly similar process and determined the formation of carbon monoxide?—Yes

And the effect of the moisture in the jar upon the carbon in the filaments, would the fact that you did it with some thicker filaments make any difference except that you got more to determine?—From a chemical point of view, no. As far as the reaction between steam and carbon is concerned there would be no difference whether it was done with a thin or thick filament.

Have you experimented to ascertain the gas that comes off from the filament during the time when it is dull red—that is, distinct from the subsequent time when it is at incandescence?—Certainly not with the "Z" filaments, but with the thicker filaments carbon monoxide was always obtained in the gases coming away.

Should we be quite safe in saying that carbon monoxide must form with moisture at a temperature of 700°?—Certainly.

What is the lowest temperature under which carbon will volatilise with heat in an atmosphere in which it is protected from any chemical influence, such as oxygen or anything of that kind—either a vacuum or a neutral atmosphere?—I do not know what the lowest temperature is at which it will volatilise—from experiment—but it is certainly a temperature of the order of 1,500° or 2,000° C.

Having regard to those facts, have you yourself any difficulty in forming an opinion as to what it is that takes out the carbon during that process when the defendants turn on the current in the jars?—No. In my opinion the carbon is oxidised out in the form of carbon monoxide.

HIS LORDSHIP: The point of all these experiments was that the gas which was used had no chemical reaction with carbon?—Yes, but there is nothing to show how it was dried or what was the purity of it, or anything of the kind.

MR. ASTBURY: Is it a matter of extreme difficulty to get all traces of moisture out of a glass bulb?—Yes, it is. And oxygen?

—Yes. If that is done while the thing is hot it takes some time, and if cold it is impossible.

Taking it as you saw it done at the defendants' place and as you had it repeated to you before, and as you tried yourself on other filaments, have you any doubt at all as a chemist that the filament goes through the stage of temperature, at which it is impossible chemically to prevent oxidation?—Yes, there must be oxidation and formation of carbon monoxide.

Now take the patent of 1904. Plaintiffs have two alternatives—one for doing it with steam and hydrogen, and one for doing it with hydrogen and nitrogen or ammonia. When they do it with steam and hydrogen, do they obtain complete oxidation of the carbon to the practical point at which the filament can then be put in and sealed up in the lamp?—Yes.

COUNSEL then read certain passages from Welsbach No. 1,535 of 1908, and asked: Is tungsten a metal which would make it impossible to apply that process to it?—Yes, it is. Because it is too easily oxidised. I should say the reason why the process would not work, is because the tungsten oxide is not volatile. I did not mean that tungsten is more readily oxidised.

Do you know of a single specification prior to the one we are suing on in this action, which suggests that you can build up tungsten filaments by the osmium process?—No.

Could anyone, in your opinion, as a chemist have foretold without experiment and research, that that could be done?—Most decidedly not.

Is there anything in either of those two Lodyguines which, in your view, taught the world anything at all about making a squirted tungsten filament?—No.

Referring to the Just and Hanaman (German) patent 154,262 (which plaintiffs disclaimed in their patent), counsel asked: Is the process there by which you are directed to get a filament at all comparable to the process in plaintiffs' 1904 patent?—No.

Have you ever heard of a practical filament made by this process?—No, I have been assured it is impossible to make them.

A number of suggestions have been made that in the defendants' process what they do is to form a carbide during the carbonising process, and then when the filaments get into the bell jar, the carbon is not there in the form of a carbon, but in the form of carbide of the metal, and that, therefore, the steam and hydrogen do not act according to the first patent in oxidising the carbon?—Yes.

MR. TERRELL: I suggested that carbide of tungsten has a very much lower melting point than tungsten; that if the current is passed through during the sintering operation, then the carbide of tungsten begins to melt. Then, physically, by the operation of the electric current, the carbon is volatilised off, which leaves pure tungsten, and that is infusible at that temperature, and that is the process of sintering.

MR. TERRELL: This answer of Dr. Passmore is admitting that there is carbide of tungsten.

MR. ASTBURY: Yes—some.

MR. TERRELL: That is all that is necessary for me for the purpose of sintering.

MR. ASTBURY: Supposing there is some trace of carbide of tungsten formed during the carbonising—has any experiment been made to ascertain whether that is so, and if so, what its percentage is?—No.

DR. ADOLPH LIEBERMANN, an expert chemical witness, was examined by MR. WALTER. Witness had read specification No. 23,899 of 1904, and satisfied himself that it worked; he also attended the inspection of the process with Sir James Dewar and Dr. Oberlander, and saw the weights used. He had made experiments with the hydrogen used by the defendants. He used a furnace heated by gas, and in this was inserted a large silica tube, into which he put a little vessel containing carbonised filaments. Then a current of the defendants' hydrogen was first dried through a calcium tube so as to imitate the conditions as closely as he could, and that was allowed to go through the tube at ordinary temperature for a considerable time to wash the whole tube out with the defendants' hydrogen. Then the apparatus was slowly heated up, and was kept at a very high temperature for about five minutes at about 1,100° or 1,200° C.

In the apparatus as used by the defendants, in your view as the result of experiments, what operation is taking place?—In my view it is a decarbonisation by means of steam and hydrogen. In his view, whether carbide or whether a mixture of tungsten and carbide was used, the action of water was to oxidise the carbon out and leave pure tungsten.

Do you find in any of the earlier literature that has been referred to in this case any disclosure of the invention set out in the plaintiffs' specification 23,899 of 1904?—I find nothing at all. In the hydrogen which was sent to him by the defendants he found ·05 per cent. of water. In 20 operations when the water was collected without any heating—viz., without the process of sintering taking place—it was ·4 of a gramme. The filaments were glowing, and the process was carried out exactly like that of the defendants. He had tried the process with different metals to see whether or not it would work as it did with tungsten; it did not work with tantalum, titanium, zirconium, thorium, or uranium.

It has been suggested that if you take nitrogen and hydrogen containing no oxygen, and pass them over a tungsten filament, no action will take place?—I have heard that, and it is utterly incomprehensible to me. It is the easiest action.

With regard to the second patent, do you find anything in the literature, which has been referred to in the cross-examination of Dr. Passmore, that would lead you, as a chemist, to use hydrogen and nitrogen free from oxygen or ammonia for the removal of carbon from a tungsten carbon filament?—No.

With regard to the third patent, what is your view with respect to that specification?—It was an inspiration.

From anything that you know of, or any literature that has been referred to in this case, is there anything that would lead you to believe that benefits would result from putting a weight, or that there was the possibility of putting a weight, upon a filament at that stage of its manufacture?—Nothing. It seems a little ridiculous to put a weight on at a period when you would expect the filament to be very much weakened.

As regards the manufacture of fine filaments by plant known at the date of this specification, do you know of any plant at that date by which fine filaments could be made at all without the use of this invention?—I cannot conceive it.

Referring to Just and Hanaman's specification, the German one, 154,262, COUNSEL asked, do you know any way not specified of removing or carrying out the suggested removal of the carbon in the oxychloride process?—I agree with the later publication of Just and Hanaman. You simply have to use steam and hydrogen.

You cannot do it on the instructions in this specification?—No.

Cross-examined by MR. TERRELL, on the specification of Welsbach, No. 1,535, WITNESS agreed that the process there described in the second method was exactly the process described by the plaintiffs in the plaintiffs' specification, except that the metal tungsten was substituted for the metal osmium.

I am talking of making a pure metal filament out of a metal which has the property of not being capable of being drawn, and Welsbach is telling you for the first time how that may be done?—Yes, how to arrive at a filament of metal of the platinum group without drawing it, but by building it up and decarbonising.

Was it known that tungsten was a metal which, in the presence of hydrogen, was not oxidised by steam at considerable temperature?—No.

Was it known that metallic tungsten could be put in an atmosphere of steam and hydrogen at a temperature of 600° to 1,000° and not oxidise?—I say that was not known.

Do you know of any useful filament of any metal which will stand treatment with steam and hydrogen?—I know of only one; that is osmium. The other one, I am told, is absolutely useless, viz., molybdenum. The latter is no good at all, the temperature at melting point is not high enough.

DR. LIEBERMANN further cross-examined by MR. TERRELL: The qualities of tungsten as a metal were well known?—Yes.

It was also known that tungsten carbides were fusible at a lower point than tungsten?—No. I do not know it, and from experiments which I have made, I cannot form any opinion whether it is so.

At the time of Just and Hanaman's German Specification 15,426, it was known that tungsten and molybdenum were particularly suitable as metals for incandescent bodies?—It was not known when it was written, because all the previous attempts had failed.

His LORDSHIP: This is an assertion on their part?—Yes, it had not been proved by experiments.

Your contention is that the defendants infringe this patent because they have water vapour in their sintering jar and in the rubber, and in the hydrogen, and it is that water vapour which removes the carbon?—Yes.

MR. TERRELL, dealing with the test of some lamps, said: About 1,080 lamps were made up with phospham and 850 without. The filaments from these lamps were analysed, and the result was as follows: In the baked filaments the carbon contents were ·804. In the sintered filaments it had gone down to ·164. The sintered filaments were then placed in the lamps, and were run for about an hour in the lamps.

The filaments were then taken out and tested again. In lamps that had had no phospham, the filaments gave an average of ·017, and the filaments with phospham gave ·019. That is substantially the same thing?—Yes.

That showed the phospham being present did not remove any more carbon than if it were not present, and so far as the carbon is concerned the phospham played no part?—Do you mean to say that this ·16 which was in the filaments was without any further treatment reduced in the lamps to ·017.

His LORDSHIP: Your point is the double process of evacuating lamps and renewing them has resulted in practically the same amount of carbon being removed from each?

MR. TERRELL: That is my point. Therefore in the lamp that contains phospham there is much more likelihood of there being a reaction removing carbon by moisture than in the lamp that does not?—I agree with you, unless the quantity of oxygen is large.

Therefore, if the lamp that contains phospham has a greater tendency to lose carbon by moisture than the lamp that does not contain phospham—if you expect a fair quantity of carbon to be removed by the action of hydrogen and nitrogen, how do you account for the fact that the lamps that do not contain phospham as a matter of fact contain practically the same quantity of carbon at the end as the lamps that do?—If I understand you rightly, you are omitting a fundamental consideration. The lamps that had no phospham added were sealed up, and had been done with. There was no more evacuation or anything else, they were simply then run for an hour. Now, the other one had the phospham application during 30 minutes.

You have said that the gases given off by the phospham would, at the beginning, contain moisture?—There is always moisture in the beginning.

And as the operation proceeded, the percentage of moisture would get less?—After a short time the moisture would have disappeared, because you heat not only from the inside, but also from outside.

Have you taken any steps to ascertain whether, when you get

evolution of cyanogen, the moisture has completely ceased?—Yes I have made experiments which make it absolutely certain that no moisture can be present when cyanogen compounds are formed.

And you say that by using phospham the defendants infringe?—Yes.

I am talking of traces of moisture on the sides of the bell jar of the character of ·2 per cent. in the hydrogen and moisture and of the india-rubber. Would that moisture spoil the formation of hydrocyanic acid?—If sufficient to oxidise the carbon it would.

That quantity of moisture is very small?—It depends on the filament. I used a filament containing 10 per cent. of carbon.

Why did you use a filament containing 10 per cent., that is not a commercial filament?—Why not.

I thought that commercial filaments that were made by defendants, and which were the subject of the action, contained ·6 to ·7 per cent. of carbon, or 8 per cent. when carbonised and ·14 when sintered.

MR. ASTBURY: These are only the thin ones which you have obliged us by showing to us up to the present.—WITNESS: You can have any percentage of carbon.

MR. TERRELL: Have you heard of people making filaments nowadays with 10 per cent. of carbon?—I do not know. I have seen them frequently with 5 per cent., and I think that is the ordinary manufacture.

MR. TERRELL, referring to the old process in Specification 19,379 of 1905, read: "It has been proposed to remove this carbon by heating the filament to incandescence by means of the electric current in an atmosphere of steam in the presence of free hydrogen, but this operation fails to remove the carbon in an entirely satisfactory manner. If, moreover, the incandescence filaments be heated in a vacuum or an inert atmosphere to a white heat carbides are produced, which either form the entire material of the filament or render it so impure that its value for lighting purposes is diminished."—I do not agree to that statement at all. All experiments have proved to the contrary.

Proved what?—That you get good filaments and the carbide formation does not interfere with it. I think it is a basis of making a patent. It is put in to establish a basis, so that there would be subject matter in the part following.

So that there may be no doubt about what we are talking about, will you look at Specification 15,510 of 1907, which is alleged as a prior grant, and also bear in mind Specification 19,379 of 1905. We say that this is a prior grant of your specification of the second patent which we are now discussing. It begins "In British Specification No. 23,899, of 1904," that is the first one on which you are suing us—"is described a method of making tungsten and molybdenum filaments for incandescent lamps, which so far as this specification is concerned may be briefly summarised as consisting in first forming a combination of such substances with carbon as a binding medium and then removing the carbon by subjecting the filaments to the passage of an electric current in an atmosphere of steam and hydrogen, so as to oxidise the carbon and leave a metallic filament, and in our prior specification 19,379, of 1905, we have described a limitation as to the proportion of water vapour to hydrogen, which our experiments led us to believe need only be from 1 to 2 per cent. of water vapour," so that there they are distinguishing the first patent from their own first patent by pointing out in our specification 19,379, of 1905, we were only going to use a small quantity of water vapour?—But in the very description they give they do not say it is a limitation, it is steam and hydrogen.

Then he gives a process by which he says, remove all possible traces of moisture and you will still, because your plant must of necessity be inadequate, have traces left, and these traces are enough?—Experiments prove that it is untrue. You can remove all the oxidising substances easily, and you can remove your carbon by means of the formation of hydrocyanic acid.

His LORDSHIP: What you mean is, that you could not form hydrocyanic acid if you had any of the oxidising gases in?—Yes.

(To be continued.)

COMPENSATION CLAIM.

A part-heard case in which Wm. Henry Stephens, of Fleetwood, claimed damages under the Compensation Act, from the Blackpool and Fleetwood Tramroad Co., was re-opened before Judge Hamilton, on May 2nd. Applicant, it was stated, was formerly a colour-sergeant and had suffered sunstroke, which brought on epileptic fits. He obtained employment on the Blackpool and Fleetwood Tramroad. Suffering two fits whilst on the cars, he was appointed storekeeper and timekeeper at 28s. per week. On January 11th, 1911, he had a fit and fell into the fire, burning his clothes. Again, on February 8th, he had a fit and fell into the fire, in which the back of his head was burned. A son of Mr. Cameron, the general manager, saw the man in this dangerous position and rescued him. He was between life and death for a considerable period.

For the man, MR. CALLIS commented that they had occupied nearly two whole days hearing discussion as to whether respondents should recompense this man for an accident. A company with capital amounting to hundreds of thousands wasted more money in defending the case than it would have cost to compensate the applicant.

His HONOUR reserved judgment, and said he would probably view the scene of the accident.

ELECTRICAL COOKING AT EARL'S COURT.

THROUGH the courtesy of Mr. R. S. Downe, the hon. manager of the Electric Restaurant, which will, we believe, form one of the conspicuous features of the Shakespearian Exhibition which was to be opened at Earl's Court yesterday, we were recently enabled to inspect the very complete installation of cooking apparatus which is to be used there.

The Electric Restaurant—otherwise known as the Queen's Head—is intended for actual catering purposes; in fact, the adjoining Boar's Head Restaurant is also to be supplied from the same cooking installation; and while in Mr. Downe's experience the reliability of the electrical cooking apparatus is not in question at the present time, the practical experience which is gained by all concerned of the behaviour of this plant over the several months' run of the Exhibition will prove a most valuable asset to the electrical fraternity.

Commercial electrical cooking on a considerable scale has, of course, been adopted in several instances in this country with perfectly satisfactory results, but the Queen's Head Restaurant can claim the most extensive array of apparatus for this purpose, being designed to supply 1,000 meals at one sitting.

A complete list of all the large apparatus is as follows:—

ELECTRIC AND ORDNANCE ACCESSORIES CO., LTD.

One boarding house cooker	13 KW.
Two domestic cookers: each	5¼ "
One carving table and hot cupboard	4 "
One grill	5 "
One toaster	6 "
One 6-gal. circular boiler urn	3 "
One 10-gal. hot water urn	4 "

GENERAL ELECTRIC CO., LTD.

Two domestic cookers: each	6 "
One grill	4 "
One brisket boiler	3½ "
One 3-gal. hot water urn	2 "

MESSRS. T. & J. JACKSON, LTD.

One grill	6 "
One double cooker, with six boiling rings ...	13 "
One special boiler	4 "
One small domestic cooker	4·5 "

MESSRS. PURCELL & NOBBS.

One domestic cooker	6·5 "
One fish and potato frier	7·5 "
One carving table and hot cupboard	5 "
One egg poacher...	2·5 "

MESSRS. SIEMENS BROS. DYNAMO WORKS, LTD.

One domestic cooker	7 "
One double urn	2·6 "
One cafe au lait	86 "
One coffee and milk urn...	2·6 "
One 10-gal. boiler with steamer	7 "

BERTRAM THOMAS.

One No. 1 electric cooker complete	4 "

FERRANTI, LTD.

One small oven	·8 "
One duplex boiling plate	1·6 "
One single boiling plate	·8 "

The cookers are arranged along one side of the hall with suitable counters, and the two big carving tables, with hot plates, in front; the counters are designed to carry all the still-room apparatus such as grills, hot-water urns, &c.

For drawing off fumes from this part of the building a 12 in. duct is provided, running along the top of the partition behind the range of cookers, in connection with a 3½-H.P. Sturtevant exhaust fan outside the building; the fish and potato frier is provided with a special 15-in. fan for dealing with the usually obnoxious fumes arising from this process.

It may be mentioned that the restaurant has been arranged jointly by the various manufacturers of cooking apparatus mentioned and the Publicity Committee, and that the Brompton and Kensington Electricity Supply Co. is providing the electricity supply.

The Brompton Co. has for 18 years supplied a portion of the Exhibition grounds, and had a 300-KW. sub-station in use, but, for the special purposes of the electrically equipped restaurant, the company has equipped another sub-station, with three 50-KW. Berry transformers, giving a supply of single-phase 83-cycle current at 200 volts pressure.

On the L.T. side, the transformers feed through a L.T. board and two 3 twin cables leading to two 400-ampere D.P. main switches and two 12-way D.P. distribution boards for supplying the various apparatus.

The L.T. sub-station board and distribution boards are fitted with switch fuses, and were supplied by Messrs. Prestwich & Burt, of Kingston-on-Thames.

Each distribution circuit consists of a Martyn twin-wire armoured cable, connected direct to the stove terminals—the stoves being wired complete, and their casings earthed on to the wire armouring of the cable; suitable metering arrangements are provided on the distribution boards. For the apparatus on the counters, Lundberg three-pin switch plugs (one plug being for earthing) are provided.

A semi-circular demonstration table has also been provided on one side of the hall for showing small accessories, such as toasters; switch plugs for connecting the apparatus are provided under the counters and at floor level on either side.

For the lighting of this restaurant, which has been newly decorated, eight 16 in. dished Holophane fittings, each with one 400-C.P. 100-volt lamp, are suspended from the ceiling, while four 100-C.P. 200-volt lamps are provided on the centre fanlight. Over the latter 22-300-C.P. 200-volt lamps in Benjamin reflectors serve for concealed lighting, the glass being partially obscured by coloured gauze.

A certain amount of concealed lighting with Benjamin two-light reflectors has been provided over the cookers as also 100-C.P. lamps in the verandah outside. Messrs. Siemens Bros. Dynamo Works were responsible for the whole of the lighting, their distribution boards being also fitted.

Great credit is due to those concerned in this enterprise, which, whatever its result financially, will undoubtedly prove an object lesson in electrical cookery, and an invaluable means of demonstating indirectly the many attractive features of the electrical cooking apparatus.

BUSINESS NOTES.

Book Notices.—"*Manual of Electrical Undertakings and Directory of Officials.*" E. Garcke. 1912-1913. Vol. XVI. London: Electrical Press, Ltd. 21s. net.—It is always difficult to find something new to say regarding a fresh edition of a work of this kind. By this time so many of our readers have either purchased or seen the *Manual* that the character of its contents and its general usefulness are well known. The information relating to electrical undertakings and businesses—whether under municipal or company ownership—including financial, commercial and engineering particulars, is very completely given in separate sections, according to their class and to their geographical location—at home or abroad. Many matters of interest are as usual covered under "Progress of the Year," including the rating of tramways, applications to Parliament for powers, wireless telegraphy, electricity in mines, the I.E.E. new articles, and so forth. There are comparative summaries of the financial results of electric lighting and traction undertakings; electric supply and railway maps have been brought up to date; there is a map of the underground telegraph lines, and a large new map showing the situation of all lighting power and traction undertakings in the United Kingdom. A list of members of the electric lighting and tramway committees, and a directory of 12,000 addresses of officials and others, are among the numerous features of a book which, at this date, requires no recommendation.

"*Journal* of the Institution of Electrical Engineers." Vol. XLVIII, No. 212. London: E. & F. N. Spon, Ltd. Price 5s.—The issue for March contains the following papers:—Automatic Reversible Battery Boosters, by R. Rankin; Residence Tariffs, by A. H. Seabrook; The Production of Electric Oscillations, by A. S. M. Sörensen; An Automatic Starting Device for Asynchronous Motors, by N. Pensabene-Perez; The Circle Diagram for the Three-phase Induction Machine, by T. F. Wall; Dynamometer Amperemeters and Voltmeters, by J. L. D. Ridsdale; Hysteresis Loss in Iron taken through Unsymmetrical Cycles of Constant Amplitude, by M. Rosenbaum; Losses in Induction Motors arising from Eccentricity of the Rotor, by C. F. Smith and E. M. Johnson; An Indicating Coil for applying the Oscillograph to the Study of of Commutation, by Prof. D. Robertson.

"*Proceedings* of the Physical Society of London." Vol. XXIV. part 3. April 15th, 1912. London: *Electrician* Printing and Publishing Co., Ltd. Price 4s. net.

"Tables Annuelles de Constantes et Données Numériques de Chimie, de Physique et de Technologie." Vol. I, 1910. London: J. & A. Churchill. Price 24s. net.

Transactions of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVIII, part 5. April, 1912. Newcastle-on-Tyne: Andrew Reid & Co., Ltd.

"The Physical Review." Vol. XXXIV, No. 3. March, 1912. Lancaster, Pa.: The *Review* Office.

"*Bulletin* Scientifique de l'Association des Elèves des Ecoles Speciales." January and February, 1912. Liége: Lahaye & Co. Price 75 cents.

"*Transactions* of the Illuminating Engineering Society." Vol. VII, No. 3. March, 1912. New York: The Society. Price 75 cents.

"The Development of the Incandescent Electric Lamp." By G. Basil Barham. 1912. London: Scott, Greenwood & Son. Price 5s. net.

"Prüfungen in Elektrischen Zentralen." By Dr. E. W. Lehmann-Richter. 1912. Brunswick: Vieweg & Lohr. Price M. 20.

"Applied Science." April, 1912. Toronto: University Engineering Society.

"*Proceedings* of the American Society of Civil Engineers." Vol. XXXVIII, No. 4. April, 1912. New York: The Society.

"Science Abstracts." Sections A and B. Vol. 15, Part 4. April, 1912. London: E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"Irrwege der Naturlehre." By Johannes Zacharias. 1912. Hamburg: Hephaestos-Verlag. Price M. 1.

"Collected Researches of the National Physical Laboratory." Vol. VIII. 1912. Teddington: From the Laboratory.

The first number of the "Donuts" magazine appeared last month; it is announced as an "aperiodical," the next issue being due when published. It is an amusing production, emanating from the Donut's Society of the B.T.-H. Co., Rugby.

We have received from the Central Translations Institute, 16, Eastcheap, E.C., a specimen of their "standard metric equivalent tables comprising weights, measures and prices in francs and marks," neatly printed on a large card suitable for hanging up. Provision is made for ascertaining practically every equivalent between British and metric weights and measures, and also between sterling prices and the equivalent prices in francs and marks per unit. The prices are worked at the par exchanges of fr. 25·23 to the £, and marks 20·40 to the £ respectively. The price is 1s. 2d. post free.

Bankruptcy Proceedings.—C. A. SMITH (trading as C. J. Smith, electrician, 23, King Street, Regent Street, London).—The last day for the receipt of proofs for intended dividend is May 22nd. Trusteee, E. S. Grey, Official Receiver, Carey Street, W.C.

DAVID ROBERTS, electrical and motor engineer, Derby.—Order made April 2nd, suspending discharge for two years.

Dissolutions and Liquidations.—THE BERRY CONSTRUCTION CO., LTD.—With a view to effecting an amalgamation of this company with the British Electric Transformer Co., Ltd., a resolution has been passed for voluntary liquidation. The meeting of creditors of the company provided for by sub-Section of Sec. 188 of the Companies' (Consolidation) Act, 1908, will be held at the offices of Messrs. Biddle, Thorne, Welsford, & Sidgwick, 22, Aldermanbury, London, E.C., at 11 o'clock on 15th inst. Liquidator, Mr. J. C. Wrist.

PHILLIPS & TURNER, electrical suppliers and hardware merchants, 71, Broad Street, Birmingham.—Messrs. C. F. Phillips & R. S. Turner have dissolved partnership. Debts will be attended to by Mr. R. S. Turner, who will continue to trade in the firm's name at the same address.

S. THOMAS PEMBERTON & CO., electrical manufacturers' agents and specialists, 8, Church Street, Colmore Row, Birmingham.—Messrs. S. T. Pemberton & H. W. Clarke have dissolved partnership. Mr. Pemberton will attend to debts, &c., and continue the business under the same style.

POWER PUBLISHING CO., LTD.—This company is winding up voluntarily, with Mr. E. W. Sanger, 6, Bouverie Street, E.C., as liquidator.

TELEPHONE DEVELOPMENT CO., LTD.—A meeting will be held at Telephone House, Victoria Embankment, E.C., on June 6th, to hear an account of the winding up from the liquidator, Mr. M. W. Jenkinson.

Japan.—The Belgium Consul at Yokohama gives the names of the following firms in Japan as importers of electric lamps:—Takata & Co., Tokio; Oki & Co., 4 Tamachi 4 chome, Shiba-ku, Tokio; Ypnei Shoten, 12 Ginza Nichome, Kyobashi-ku, Tokio; Dewette & Co., Tokio; Nippon Electric Co., 2 Mita Shikoku-machi, Shiba-ku, Tokio; Andrews & George, 242, Yokohama; Iwai Shoten, 12 Himono-cho, Nihombashi-ku, Tokio; Kitahama, 4 chome Higashi-ku, Osaka.

Patent Application.—Application has been made for the restoration of Patent No. 24,411, of 1905, for "Improvements in and relating to the regulation of the supply of liquid fuel to internal combustion motors," granted to G. Brandstetter.

Catalogues Wanted.—MR. J. HODGSON, electrical contractor, P.O. Box 2,614, Johannesburg, wants catalogues of electric cooking, heating, hot water and lighting apparatus, for private residences, together with prices, power consumption, &c.

Old Dutch Fittings.—MESSRS. W. J. STOKVIS, of Arnhem, Holland, the well-known manufacturers of the artistic old Dutch style lighting fittings, replicas of the seventeenth century, were last week honoured by an official visit of Her Majesty the Queen of Holland and H.R.H. Prince Henry of the Netherlands at their works. Her Majesty has graciously sanctioned the firm styling themselves "The Royal Metal Works."

A New Swiss Aluminium Enterprise.—The United Aluminium Works Co., of Schaffhausen, is the title of a new company which has been formed, with a share capital of £80,000, for the amalgamation of the firms of Dr. Lauber, Neher & Co., of Schaffhausen, Dr. Lauber, Neher & Co., of Singen, and the Aluminium Co., of Tenningen. All three firms are engaged in the production of aluminium sheets and foil.

Canada.—H.M. Trade Commissioner for Canada reports that an engineer of a town in Western Canada desires to obtain catalogues of manufacturers of hand cars, hoists, ice and refrigerating machinery, jacks, lamp-posts, levels, locomotives, manhole covers, water, oil and gas meters, electric motors, paints and metal coverings, penstocks, and perforated metals. The name and address can be obtained at the Board of Trade Commercial Intelligence Department in London.

The Insurance Bill.—A proposal is on foot to organise an approved society under the Insurance Act in the British Westinghouse Works, Manchester, in order to administer the benefits of Part 1 of the Act, and on Friday a meeting of all the employés was held to consider the scheme during the dinner hour. Mr. P. A. Lange, managing director, presided, and said that the company offered every facility for carrying on the society. A resolution was submitted to the meeting to the effect that a works society be formed, and was strongly supported by those present.

A correspondent says the heads of various municipal electricity departments in Manchester, Salford, Bury, Eccles and other parts of south-east Lancashire have recently held conferences with respect to the working of the Insurance Act.

For Sale.—The Corporation of Taunton has for disposal sixty 7—10-ampere D.C. Brockie-Pell arc lamps, a number of A.C. flame arc lamps, and a quantity of globes and solid carbons. The Stockton-on-Tees Corporation has for disposal a number of Crompton arc lamps, resistances, cut-outs and accessories. See our advertisement pages to-day.

Business Tour Through Canada.—The *Times* states that a party is being organised, to consist of representatives of about 100 leading commercial or manufacturing firms in this country, for an excursion through Canada. The enterprise is a private one, but will be facilitated by the Canadian Government.

Catalogues and Lists.—Messrs. Bruce Peebles and Co., Ltd., Edinburgh.—Pamphlet No. 13B (28 pages) containing particulars of their A.C. generators, in sizes AD 10 to AD 70 inclusive. Full specification information and half-tone illustrations are given, also a number of pages of tabulated details of ratings of standard 50 and 25-cycle machines for a range of speeds of from 1,000 to 125 R.P.M. at pressures of from 200 to 2,200 volts. Rules are published for selecting the correct machine for other periodicities that are not listed, and full lists of approximate weights and dimensions are included, followed by a list of home and foreign users.

Mr. C. A. Matthews, 47, Grange Road, Chorlton-cum-Hardy, Manchester.—A number of illustrated descriptive pamphlets, has been received, dealing with the following:—"Ohnesorge" power equalising clutches, "Bamag" belt shifters for cone pulleys, and "Dohmen-Leblanc" friction clutches.

The Lennox Foundry Co., Ltd., Tantiron Foundry, Glenville Grove, New Cross, London, S.E.—48 pp. catalogue, giving particulars relating to "Tantiron," an acid-resisting alloy, and manufactures made thereof, including nitric acid stills and condensers, pans and vessels for foundry and other service, pumps, pipes, valves, &c., and the Lennox electric blower. The pamphlet is fully illustrated.

Messrs. Wailes, Dove, & Co., Ltd., Newcastle-on-Tyne.—Twenty-page pamphlet containing a great deal of information respecting their patent "Bitumastic" solution for protecting ironwork, pipe lines, blast furnace plant, steel chimney stacks, tanks, bridges, and so forth.

The Armorduct Manufacturing Co., Ltd., Farringdon Avenue, London, E.C.—Leaflet No. C/1149, containing illustration, particulars, and prices of the Premier electric vacuum cleaner, a box-type machine for hotels, public buildings, mansions, &c. The word "Premier" is on every cleaner. The machine case is of polished oak with inlaid rosewood top. Six bellows, actuated by a malleable steel crank running in ball bearings, ensure continuous suction. The dust is drawn into an air-tight steel dust-box, which can be removed when necessary. A metal spiral flexible suction tube, with one carpet mouthpiece and one small mouthpiece for concentrated suction, are supplied with the machine.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—1912 season list of prices (with illustrations, &c.) of "Antarctic" electric motor fans for C.C. and A.C., for table, wall, and ceiling service.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Four-page leaflet entitled "Aluminium in the Foundry" showing castings for an eight cylinder crank case and radiator parts cast in aluminium. Tabulated information is given relating to B.A. standard casting alloys, and comparing the properties of aluminium, brass, bronze and iron for foundry work.

Messrs. Ruston, Proctor & Co., Ltd., Lincoln.—Four-page leaflet describing the Ruston patent crude oil engine and giving sizes, dimensions, &c., of single and double cylinder engines. One of the illustrations shows three 50-B.H.P. engines direct coupled to dynamos at the Lucknow Medical College, India. A large loose print illustrates a 130-B.H.P. "Ruston" throttle valve suction gas plant.

Messrs. W. T. Henley's Telegraph Works Co., Ltd., Blomfield Street, London Wall, London, E.C.—12-page "aerial list" containing tabulated prices of aerial cables for use overhead on insulators (bare, single-braided, taped and single-braided, double-braided, and triple-braided). The firm's patent cable suspender is also described and priced, and a table gives particulars of steel suspension wires.

Messrs. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C.—28-page pamphlet containing illustrated particulars and prices of "Aston" switchgear conforming to Home Office Regulations. The manufactures covered include H.O. knife switches, heavy service switches, double-throw or change-over switches, H.O. handle fuses, "Vim" ironclad switches, fuses, distribution boards, and V P circuit breakers. Dimension drawings and particulars of weights are included.

The British Thomson-Houston Co., Ltd., 77, Upper Thames Street, London, E.C.—This company has just issued a folder relating to its "eye-rest" system of indirect lighting. Information is given regarding the different styles, finishes and prices of these fittings, and some photographs are reproduced of existing installations of indirect lighting. "Eye-rest" fittings are supplied with either "carton pierre" or metal bowls, and in a number of different finishes. Inside the bowl are fixed one or more reflectors—according to size of bowl and number of lamps used—and the light is first thrown on to the ceiling and from thence reflected evenly over the room. The reflector used, known as the "X-ray," is made of corrugated silvered mirror.

Trade Announcements.—The British Electric Transformer Co., Ltd., 29A, Charing Cross Road, W.C., which has hitherto carried on the manufacture of the "Tricity" cookers for the Berry Construction Co., Ltd., announces that having now purchased the entire business of the latter, including patents, trade marks, &c., it will henceforth carry on the business in its own name.

Messrs. Scholey & Co., Ltd., of 151, Queen Victoria Street, London, E.C., have been appointed sole agents for this country for the Electric Speedometer Co., of Boston, U.S.A.

Mr. Oliver Snowden has commenced business as an electrical engineer, &c., at Regent Street South, off Eldon Street, Barnsley.

The Thomson Co., late of 53, Back George Street, Manchester, have removed to very commodious works (Marlborough Works, Marlborough Place, Clifford Street, Oxford Road, Manchester), where they are now turning out large quantities of their speciality, portable electric lamps. A new catalogue can be obtained on application.

The Metallic Seamless Tube Co., Ltd., Wiggin Street, Birmingham, have appointed Mr. A. J. Holman as their Newcastle and district manager, and increased stocks of conduits, cables, accessories, &c., will be held at his address at 17, Eldon Square, Newcastle-on-Tyne.

The Synchronome Electrical Co., of New South Wales, Ltd., has been registered, with a capital of £5,000, in shares of £1 each. The first directors are Messrs. A. Ward and A. H. Pace. The operations of the company were started about three months ago.—*Australian Mining Standard.*

LIGHTING and POWER NOTES.

Accrington.—The Electricity Committee has given consideration to a scheme for substituting for the present system of lighting the main roads, one using overhead equipment over the roads, with incandescent electric lamps. Automatic switches are to be fixed to the service in each road in order that the entire lighting of the main roads can be controlled from the Superintendent's office. The total cost of the undertaking will be £419 and the total cost of lighting per year £269. The candle-power of the lamps will be increased from 9,780 to 12,100.

An application from Messrs. Highams, Ltd., for a supply of 400,000 to 500,000 units per annum, has been granted on the following terms. The price to be 5d. per unit with a limit of 5 per cent. for lighting purposes, with the usual condition as to fluctuation in the price of coal. Period of supply, 7-10 years.

An application from the Albion Mill Company, for a supply for driving 266 looms (estimated consumption 220,000 units per annum) was granted on similar terms.

Ashton-under-Lyne.—The B. of G. has referred back for further consideration the proceedings of a special committee appointed to deal with the question of the electric lighting of the workhouse, etc. The committee recommended the Board to accept the tender of Messrs. Swainson & Co., Booth Street, Manchester, amounting to £653 for carrying out the work.

Atherton (Lancs.).—The U.D.C. has decided to reduce the charge for electricity to be used for cinematograph purposes.

Bath.—The T.C. is recommended to apply to the L.G.B. for a loan of £3,000 for mains extensions principally in the Westor, Combe Park, and Newbridge Hill districts.

Bentham (Yorks.)—A meeting has been held at High Bentham to consider a scheme, estimated to cost £3,000, for supplying electric light and power to High and Low Bentham and Burton-in-Lonsdale. Full particulars of the proposals were laid before those present, and a Committee was appointed to go further into the matter.

Blackburn.—The T.C. has sanctioned the carrying out of a scheme prepared by the borough electrical engineer for the extension and improvement of the electric street lighting in the centre of the town and along the tramway routes.

Burton-on-Trent.—With reference to the proposed municipal showroom mentioned in the last issue of the Electrical Review, the Chamber of Trade has passed a resolution opposing the scheme. At the meeting of the Chamber two members of the Gas and Electricity Committee of the T.C. mentioned that it was the intention of the Committee to consult with the traders more immediately concerned before deciding upon any definite line of action.

Canterbury.—The T.C. on May 1st received from the Lighting Committee a recommendation not to entertain the offer of the National Electric Construction Co., Ltd., to sell its rights in the free wiring installations in the city for £150, the town clerk having advised that any payment should come from the consumers using the wires, and not from the ratepayers. It was stated that at Canterbury there were now only two consumers using the company's wires, the original number being 22, while the installations cost £323.

Cheltenham.—The B. of T. has granted the T.C. a prov. order enabling it to supply current in the parishes of Leckhampton and Prestbury, in the area of the R.D.C., the charges for current to be the same as in the borough. At the L.G.B. inquiry the proposed extension was stoutly opposed by the R.D.C.

Continental Notes.—Greece.—A new company at Athens is the Ionische Elektricitäts-Gesellschaft K.A. Raftopoulos und Co., with a capital of 112,000 drachm. The company has been formed to supply electrical power.

Russia.—From the report of the Société d'Eclairage Electrique de Saint-Petersbourg, we learn that the the mains for private and public electric lighting were extended from 418 to 425 km. during the past financial year. A new steam turbine and alternator of 6,700 H.P. were put down at the generating station, the capacity of which is now 21,500 H.P.

The question of the electric lighting of the town is at present being considered by the municipal authorities of Rjasan.

Spain.—La Sociedad Electra de Velin has acquired the concession to utilise the water power of the river Bubal at Bibale in the generation of electrical energy for lighting and power purposes.

France.—A concession has lately been secured by La Compagnie Departmentale d'Energie Electrique for the electric lighting of the town of Coulonges-sur-l'Autroc (Deux-Sevres).

Creswell (Derbyshire).—Arrangements are being made by the directors of the Bolsover Colliery Co. to install fresh plant at the Creswell Colliery to supply every house in the village with electric light at 3½d. per unit. The scheme has been approved by a Committee of the Parish Council, and the parishioners are to be called together to give their assent.

Croydon.—In reference to the agreement entered into with the County of London Electric Supply Co., Ltd., for the supply of energy in bulk, the Lighting Committee has recommended that the terms of payment by the company to the Corporation shall be as follows: A sum of £1 5s. per quarter per KW. of maximum supply demanded. The actual maximum demand supplied under the agreement shall be ascertained by the average readings of two "Merz" or other agreed demand indicators, which shall be provided and fixed by the Corporation. These instruments shall be calibrated to record maximum demands extending over a period of 15 minutes each. If the readings of the two instruments vary more than 3 per cent., the instruments shall be tested and re-calibrated by the inspector, as provided for by the agreement. An additional charge of ¾d. per unit is to be made for all units supplied as measured by meters under the conditions set out in the agreement, and the Corporation will allow the company discounts upon the prices at the following rates: For electrical energy supplied when the amount of the account lies between £100 and £250, 5 per cent.; £250 and £500, 7½ per cent.; £500 and £750, 10 per cent.; £750 and £1,000, 15 per cent.; £1,000 and £1,500, 20 per cent.; £1,500 and upwards, 25 per cent. The average price actually charged under the agreement is not to exceed 2½d. per unit.

Dartford.—A L.G.B. inquiry was held last week into the application of the U.D.C. for a loan of £10,000 for new plant at the electricity works. As it was not intended to provide a new boiler for some time, the amount of the loan was reduced by the Inspector to £8,685. There was no opposition.

Eastbourne.—The Electricity Committee has decided to install coal conveyors, elevators, &c., at the electricity works, at an estimated cost of £1,181.

Glasgow.—The T.C. purposes promoting a second Smoke Abatement Exhibition in the city from September 20th to October 12th next. Nearly all the available space in the large building engaged has already been taken up. A special feature of the show will be the combined exhibit of the T.C.'s Electricity Department and the Electrical Allied and Trades Manufacturers' Associations, which will take the form of an electrical luncheon and tea room, including a kitchen. A joint meeting will take place in London in a few days to decide the design of the exhibit and other details. All the latest electrical appliances are to be shown, and the object will be to show the uses which can be made of electrical energy for domestic and other purposes. The expectation is that, on the invitation of the T.C., representatives of many public bodies throughout Great Britain will visit the Exhibition.

Hastings.—At a meeting of the B. of G. the first quarterly accounts for the electric light (recently installed in the whole of the workhouse buildings) were passed. For the period covered—January 4th to April 13th—the saving (comparing the accounts with those for gas in the corresponding period) amounted to £33. Naturally, general satisfaction was expressed.

Holmfirth.—The B. of T. has sanctioned the application of the U.D.C. for a prov. order for the electric lighting of the district.

London.—At the fortnightly sitting of the Metropolitan Asylums Board, it was reported that the Charing Cross Electricity Supply Co. had given formal notice of its intention to determine at the end of June its existing contract for the supply to the head office of electricity for power and lighting. The company was, however, prepared to enter into a fresh agreement with the managers for the supply of electricity at 3½d. per B.T.U. for lighting and 1½d. per B.T.U. for power and heating, as against 3d. and 1d. under the agreement with the Board dated September 29th, 1904. The engineer-in-chief reported that the reasons assigned by the representative of the Charing Cross Co. for the increase in the rates are the increased cost of coal and other materials, and the obligations of the company under the Insurance Act; and advised that the revised terms be accepted, and that two separate meters be fixed for existing radiators. This was agreed to.

Marylebone.—At a meeting of the B.C. on May 2nd, the report of the Electric Supply Committee which, as noted in our issue of April 26th, was not reached at the previous Council meeting, was discussed. The report recommended that the Council should continue the sales department on existing lines, subject to certain modifications set forth. The modification related to the method of sub-contracting, the Council agreeing to a tentative proposal that, instead of all the work being placed with one contractor, the borough be divided into districts which were to be allotted between eight contractors, or if there were more than eight contractors, the larger districts to be further divided. Col. Hopkins, chairman of the Committee, in moving the adoption of the report, amplified the information set out. He made a special point of the fact that, while various complaints as to the conduct of the department were said to exist, only one such complaint had been brought before the committee by the Electrical Contractors' Association, despite repeated invitations to bring proofs, and that one specific case had been proved to be fallacious. He further spoke of the proposal by the contractors that all wiring work be thrown open to be competed for by all the contractors in the borough. One could easily understand, remarked the Colonel, that if there were a small job of wiring, say, £3 or £4, that it would be futile offering that to all the contractors. On the face of it, it was impossible. The contractors, he said in conclusion, practically asked the Council to close the sales department down, but that it declined to do. Mr. Oswald Lewis moved, as an amendment, that they determine "to continue the department for the present," &c. There were two questions before the Council, he said, one whether they should have a department or not; the other whether, if they had a sales department, they should conduct it on existing lines or not. He wished to keep to the former question, and he would like them to divide on the point, so that the electors would be able to see who voted for the continuance or the cessation of a sales department. In answer to the chairman of the Committee, he urged that if only one complaint was brought forward, that was because the Contractors' Association had been told that specific complaints were not to be dealt with, the only question being one of general policy. Personally he had brought before the Council complaints which had never been satisfactorily answered. Mr. Duncan Watson seconded the amendment. Mr. Garrold, in taking the part of the Committee, said they must all come to the conclusion that the Electrical Contractors' Association had been unreasonable throughout. The suggestion that the department had cut prices was untrue, as was shown by the fact that it was able to make a gross profit of 40 per cent. Mr. O'Brien appealed for the continuance of the sales department. What business man, he asked, having found one department was essential to make the whole of his business successful, would at once proceed to shut down that department? Mr. H. J. Halsdon urged that the continuance of the sales department was detrimental not only to the contractors but also to the ratepayers. Mr. W. Dennis suggested for the consideration of the department the cessation of the practice of selling lamps. It could not be said that the sale of these lamps assisted or increased the sales of current by a single unit. Col. Hopkins, in his reply, despaired of ever satisfying Mr. Lewis if the explanations he (the speaker) had given from time to time had not met with his approval. He denied that the Contractors' Association was told that complaints would not be dealt with at the interview between the Committee and the Associations' representatives. As for the sale of lamps, he could assure Mr. Dennis that, while they were not anxious to carry on that business, and did not encourage it, there were good reasons why the practice should be continued. Indirectly, it encouraged the use of the current, for people once obtaining the metallic-filament lamps from the department were so satisfied that they were encouraged to use the current. The amendment being put, was lost. A further amendment by Col. Maud asked for a statement by outside accountants showing the position of the undertaking in 1909, the cost of the establishment and annual cost of the sales department, and how much profit might be credited to the sales department? This information, he said, would give them all a clearer view of the case for and against. Mr. M. Morris seconded. Mr. Russell ridiculed the idea, and went on to urge that it was too late in the day to "dilly-dally with the matter." The amendment being lost, another was put by Mr. Ince referring the matter back, but the Council being anxious to deal with the report that night, no seconder was forthcoming. The motion of the Committee, as set forth in its report, was then put and carried. At the time of the voting there was not half the members present, the attendance at the commencement being further depleted by various defections as the proceedings dragged to a close.

The Electric Supply Committee has reduced its tariff for outside illumination of shops from £8 per KW. and 1d. per unit, to £6 per KW. and 1d. per unit. The Committee has also decided to make a grant of £50 towards the expenses of the Smoke Abatement Exhibition. It has been informed that this exhibition has been of exceptional value to the department, many orders having been obtained.

Lytham.—The B. of T. has informed the U.D.C. of its decision to revoke forthwith the Lytham Electric Lighting Order, 1907, and, in reply, the Clerk to the Council has informed the B. of T. that that authority has under consideration the advisability of itself applying for an electric lighting order in December next.

A section of the Lytham residents has petitioned the St. Anne's U.D.C. to supply electric light, owing to the failure to secure a supply in the Lytham area, and in reply to an inquiry from the St. Anne's Council as to the Lytham Council's intentions, the Clerk has written informing it what is proposed to be done.

Newcastle-on-Tyne.—The Newcastle Electric Supply Co. has applied to the B. of T. for consent to the use of E.H.T. overhead transmissions for supplying current at a pressure of 20,000 volts. Three lines are proposed, one from Hartford to Dudley Colliery; another from Weetslade Colliery to Hazlerigg Colliery and Burn Pit; and a third from Dinnington Colliery to Dudley Village.

Newport.—The T.C. proposes erecting a new power station in Corporation Road, the plans of which have just been adopted by Electricity and Tramways Committee. The work will be taken in hand without delay.

Nottingham.—Much interest has been excited in the East Midlands by a proposal to harness the Trent for the production of electricity, which was discussed by the City Council on Monday. The project came before the Council in the form of a resolution moved by Councillor Albert Ball: "That the Electricity Committee be instructed to consider and report to the Council the possibilities and prospects of obtaining powers to harness Colwick and Beeston Weirs with a view to generating electric current to supply the city and district, and to ascertain from experts the power which could be relied upon at low water." The Trent skirts the southern limits of Nottingham, and Beeston Weir is situated about three miles west and Colwick Weir two miles east of the city.

The resolution met with a somewhat cool reception, although after discussion, in which members of the Council appeared to be reluctant to commit themselves to a definite expression of opinion one way or the other, the resolution was adopted, Mr. Ball accepting the suggestion that the Committee should take the advice of the Council's own officials. Alderman Sir John Turney, chairman of the Electricity Committee, in seconding the resolution, said he thought it was a tall order, and he stipulated that they should have Mr. Ball on the Committee to help them, so that it would not be a one-sided inquiry. Councillor Hobson pointed out that the Beeston U.D.C. had inquired into the possibilities of harnessing Beeston Weir for electricity purposes, and he had no doubt they would be pleased to hand over all the expert advice they obtained. He thought Mr. Ball would be astonished when he got to the bottom of the question.

Commenting on Mr. Ball's scheme, the *Nottingham Guardian* says: "There is no doubt what expert advice will be about the production of electricity from the Trent. This was shown some years ago by correspondence in our columns. Expert advice then was that the proposal was impossible, and it will be so again . . ."

Nuneaton.—The T.C. has received from the L.G.B. sanction to a loan of £7,500, for extensions at the electricity works.

Shipley.—The U.D.C. has instructed the engineer to prepare a scheme for improved street lighting by electricity.

Skelton and Brotton.—At a meeting of the U.D.C. on Friday, a motion was made to rescind the resolution recently passed accepting the tender of Graham Bros., of Middlesbrough, for the lighting of the whole of the district by electricity. The mover contended that it would be illegal to distribute electricity without an Act of Parliament or a B. of T. Order. The voting was even, and the chairman declined to give a casting vote. Notice was then given to again move the recission of the resolution at the next meeting of the Council.

Southend-on-Sea.—The assessment of the electricity undertaking of the T.C. has been increased from £2,364 to £6,250.

Stoke-on-Trent.—The T.C. has decided to supply current for domestic cooking and heating, where premises are lit throughout by electricity, at 1d. per unit.

Tadcaster.—On the recommendation of the Housing Committee, the R.D.C. has decided to have the workhouse lighted by electricity.

Tripoli.—A company has been formed for the electric lighting of Tripoli. It is the Compagnie pour l'Eclairage de Tripolis, Soc. Anonyme. Head office, Athens; capital 1,000,000 drachm.

Tunbridge Wells.—The T.C. has decided to reduce the price of current for heating, cooking, and motive power from 2½d. per unit to 1½d.

Wakefield.—The Tradesmen's Association, after considering a proposal to establish in the city a municipal showroom for electrical fittings, &c., has passed a resolution protesting against this extension of municipal retail trading, on the grounds that "the selling of electric lamps, fittings, accessories, &c., being of essentially a speculative character, is more economically and efficiently carried out by private firms than by Municipal Corporations, and that the granting of such a monopoly would result in the extinction of competition, to the detriment of the consumers and ratepayers generally."

Worksop.—The U.D.C. has applied to the B. of T. for consent to utilise overhead lines in various parts of the town for the transmission of current at a pressure of 220 volts.

TRAMWAY and RAILWAY NOTES.

Belfast.—The Corporation on the 2nd inst. decided to start a system of profit sharing in connection with the tramways. It was stated that all employés would participate, and that the distribution this year would be equal to about £4 per head.

Birkenhead.—A long debate took place at the T.C. meeting, on May 1st, upon the Tramway Committee's recommendation that application be made to the B. of T. for sanction to borrow £4,404 for the purchase of six double-bogie cars, with a seating capacity of 80 passengers, from Messrs. Siemens Bros. Dynamo Works, Ltd. An amendment was submitted that the recommendation be referred back, it being contended that the New Ferry route, catering for the Port Sunlight district, required lighter cars than those for which the tender had originally been accepted.

It was also urged that the Committee had done nothing to comply with the Council's request that it should try and reduce the weight of the cars. The amendment, which was in the nature of an instruction to the Committee to adopt the smaller and lighter type of car, was carried by 19 votes to 9.

Brazil.—The Office of Public Works in Pernambuco, Brazil, is leasing a concession for the construction and exploitation of an electric tramway system for the town of Recife and its suburbs

Canada.—The Canadian Northern Railway is experimenting with a gasoline-electric car of United States manufacture, propelled by power generated by a 200-H.P. gas engine carried above the front truck, with a view to the adoption of this type of car on its local lines. The engine is started by compressed air, and drives a generator which provides electric power for two motors working on the front truck. The gasoline tanks have a capacity of 100 gallons, which is sufficient for a run of about 200 miles. The car is equipped with electric light and a plant for compressing air for the starting and the brakes. The car is about 60 ft. long and about the same weight as an ordinary railway coach; it seats about 75 passengers.—*Board of Trade Journal.*

At a recent meeting of the Brandon Municipal Council, a draft contract was signed for the construction of an electric tramway in that town. Should the approval of the ratepayers be obtained, it is expected that at least 5 miles of tramway will be in service by the end of the year.

Carshalton.—On May 1st the South Metropolitan Co. abolished the "fair fare" system on its Sutton and Tooting tramway routes, by which farthings were charged for some of the stages, and gave notice of the fact to the local authorities. The Carshalton U.D.C., at its last meeting, expressed disapproval of the new system of fares, which has resulted, in some cases, in an increase, and has notified the B. of T. of its action. A suggestion was made that the cars should be boycotted, and attention was called to the company's agreement with the Council in 1906, which provided for the approval of any alterations by the Council, and, failing such approval, that the alterations be submitted to the B. of T.

Continental Notes.—TURKEY. — According to the Belgian Legation at Constantinople, the Ottoman Government has called for tenders for the construction and working of a system of city and suburban electric tramways in the Asiatic part of Constantinople. Tenders must be submitted before June 15th.

ROUMANIA.—The Galatz Chamber of Commerce has petitioned the Ministry of Trade and Industry at Bukarest to construct an electric tramway to link up the towns of Galatz and Braila. This project would involve the drainage of a considerable area of the marshes alongside the Danube and the construction of a dam. However, although the expense of such an undertaking would be large, there would be, in addition to the convenience of the tramway connection, a considerable surface of reclaimed land which could be used for agricultural purposes.

BELGIUM.—Of the total of 2,450 miles of local railways now being worked by the Société Nationale des Chemin de Fer Vicinaux, 225 miles are operated electrically. Plans are in hand for the conversion of another section to electric traction.

RUSSIA.—La Société des Tramways et Entreprises Electriques de la Banlieue de Saint Petersbourg is the name of a company which has lately been formed in Antwerp with a capital of £400,000.

FRANCE.—Plans are being prepared for the electrification of the Luchon-Montrejean section of the Midi Railway of France.

A scheme for the construction of an electric tramway in the town of Valence St. Peray (Drome) is at present under consideration.

Darwen.—At the T.C. on Tuesday last, Ald. Tomlinson stated that for the first time a net profit had been made on the tramways. On the main section there was a profit of £691, and on the Hoddesden section a loss of £419, leaving a net profit of £271.

Eccles.—The Salford Corporation having applied for a revision of the rates and charges for the supply of electrical energy for the tramways, the borough electrical engineer has been instructed to prepare a statement of the cost of supply for traction purposes.

Glasgow.—The T.C.'s Tramways Committee, which at an earlier meeting decided, after considering a report by Mr. Dalrymple, the general manager, not to entertain the proposal to run a service of all-night cars, or a service from midnight till 3 a.m., has, on a remit back, reaffirmed its former decision.

The Tramways Committee of the T.C. has had under consideration a recommendation of the Cowlairs Ward Committee to the effect that the time has arrived when all members of the T.C. should have the privilege of free passes on the tramway system. On a division between a proposal that the letter lie on the table and an amendment that the sub-Committee on Finance should report on the communication, the latter was carried by 9 votes to 4.

New Zealand.—The electrical engineer to the Government has submitted his plan for the replacing of steam by electric traction on the railway between Christchurch and Lyttleton. He estimates the cost of the electrical equipment—including locomotives, sub-station equipment, line equipment, and motor-car and trucks—at £100,000. The present carriages would remain in use. The line and sidings would be equipped with overhead wires, the track rails being utilised for the return portion of the circuit.

Quarry Bank.—The Quarry Bank, Brierley Hill and Rowley Regis U.D.C.'s have been granted an order by the Light Railway Commissioners transferring their powers under the Order for 1903 to a company.

Sheffield.—It has been decided to renew the tramway track in portions of Church Street, Western Bank, London Road, and Spital Hill. The present single line in a portion of Fulwood Road is to be doubled. The town clerk has been instructed to endeavour to obtain consents for the doubling of the tramway track on the Nether Green section.

Southend-on-Sea.—The Assessment Committee of the Rochford Union has increased the assessment for the Southend tramways from £1,619 to £3,170.

Stockport.—Owing to opposition on the part of the Hazel Grove U.D.C., the T.C. has decided not to extend the proposed railless car service outside the borough. The original proposal was to run as far as Marple.

TELEGRAPH and TELEPHONE NOTES.

Cables and the Spanish-American War.—Answering a question in Parliament, Mr. Acland said that only two claims arising out of the telegraph cables cut in the West Indies were preferred against the United States Government as the result of the Spanish-American War. One was by the Cuba Submarine Telegraph Company and the other by the French Cable Company. That of the Cuba Submarine Telegraph Company was presented in November, 1899, but no compensation had yet been paid. It would shortly be referred to arbitration under the Pecuniary Claims agreement with the United States.

New Zealand.—The *Australian Mining Standard* reports that the Postmaster-General has prohibited the erection of private wireless stations in the Dominion, with the exception of four owned by officers of the department, for which permits have been granted, and no further permits will be issued.

Peru.—The Government is about to establish a wireless telegraph station on the San Cristobal Hill above Lima, in order that that city may be put in communication with Iquitos. The distance between the two places is very considerable, but it is hoped to overcome all difficulties in this direction without having a relay station.

Radio-Telegraphic Convention.—The Greek and Egyptian Governments have intimated their adhesion to the Convention.

Trans-Atlantic Wireless Telegraph Service.—The Postmaster-General, on application from the Marconi Co., made arrangements to accept from the public, on and from May 1st, at all telegraph offices in the United Kingdom, telegrams addressed to places in Canada and the United States, for transmission by the company's wireless trans-Atlantic service. The full rate for telegrams to New York or Montreal is 8d. a word, the rate for cablegrams being 1s. a word, and there is a similar reduction in the full rates for telegrams for other parts of America. For deferred telegrams in plain language the rate to New York is 4d. a word, the cablegram rate being 6d., and there are corresponding reductions for other places.

The Telephone Service.—The Postmaster-General last week stated that provision was being made for the expenditure of about £2,600,000 in the extension of the trunk and local systems during the present financial year, and that new telephones were being provided in London alone at the rate of between 500 and 600 a week

Turkey.—The Government has decided to prohibit the use of wireless telegraphy by ships in the port of Constantinople.

Wireless Telegraphy at Sea.—In reply to a question in the House of Commons, Mr. H. Samuel stated that all wireless telegraph installations on board British ships were capable of being used for inter-communication with other systems, and they were worked in accordance with licences issued by the Post Office. The Radio-Telegraph Convention did not provide for the compulsory interchange of messages between ships for other than distress purposes; and the Marconi Co. declined to inter-communicate, except in cases of distress, with ships fitted with other systems unless the matter had been arranged by agreement. He was not aware that other systems were similarly hampered.

The Allan Royal Mail Line has arranged with the Marconi Co. to carry two wireless operators in every ship of the Allan fleet.

CONTRACTS OPEN and CLOSED.

OPEN.

Ashton-in-Makerfield.—May 14th. U.D.C. Centrifugal pumps and motors, cables, switchboards, wiring and accessories. See this column in our last issue.

Australia.—Victoria.—June 4th. 1,000 protectors, galvanised iron wire, galvanised steel wire and sleeves, for the P.M.G.'s Department. See "Official Notices" April 19th.

June 11th.—Electric incandescent lamps, illuminating and switchboard, and silk-covered wire, for the P.M.G.'s Department. See "Official Notices" April 26th.

Deputy P.M.G., Melbourne.—June 4th. 259,500 porcelain and earthenware insulators and batteries.—June 11th. 9⅝ miles of telephone switchboard cable; 1,000,000 paper jointing sleeves; and 252 tons of sulphate of copper.—Apply to High Commissioner in London for Australian Commonwealth.

June 18th.—50½ miles of cable, for the P.M.G.'s Department. See "Official Notices" May 3rd.

P.M.G., Melbourne.—July 23rd. Nine sections of a lamp-signalling trunk-line switchboard. See "Official Notices" April 5th.

June 4th.—The Agent-General for Victoria is prepared to receive tenders for certain works in connection with the electrification of the Melbourne suburban railways. See "Official Notices" May 3rd.

Tasmania.—June 10th. Telegraph and telephone material, for the P.M.G.'s Department. See "Official Notices" April 12th.

New South Wales.—July 31st. For Newtown, Sydney, an automatic or semi-automatic switchboard and equipment (Schedule No. 154); also 20 sections of a common-battery switchboard and equipment (Schedule No. 131). For Balmain, Sydney, 14 sections of a common-battery switchboard and equipment (Schedule No. 122); an automatic or semi-automatic switchboard and equipment (Schedule No. 151). For Glebe, Sydney, automatic or semi-automatic switchboard with associated apparatus (Schedule No. 153).—*Australian Mining Standard.*

Western Australia.—July 31st. P.M.G.'s Dept. Telegraph and telephone material. See "Official Notices" to-day.

Belgium.—May 25th. The municipal authorities of Ghent are inviting tenders for four steam boilers, with economisers, at the central electric lighting station.

Birkenhead.—May 27th. Electric light installation at the Union Workhouse, Tranmere, for the B. of G. See "Official Notices" April 26th.

Bohemia.—Smichow.—May 22nd. Tenders are invited for the supply of a steam turbine and two dynamos. Particulars of the Canzlei. No. 10A des Stadtischen Rathhaus, Smichow.

Constantinople.—June 15th. Tenders are invited for the establishment of electric tramways in the Asiatic part of the capital. Particulars, in French, from the Minister of Public Works on forwarding the equivalent of 10s. in Turkish money (half of £T).

Derby.—One water-tube boiler, for the Corporation Electricity Department. See "Official Notices" May 3rd.

Edinburgh.—May 11th. Coal for the Electricity Supply Department for three or twelve months. Engineer's office, Dewar Place. Deposit 10s.

France.—June 5th. The French Post and Telegraph authorities in Paris (103, Rue de Grenelle) are inviting tenders for the supply of a multiple telephone switchboard for the Telephone Exchange at Roubaix.

Germany.—May 15th. The Prussian State Railway authorities at Halle-am-Saale are inviting tenders for a 25-ton electrically-operated travelling crane.

Glasgow.—May 10th. Sub-station switchgear, for the Corporation Electricity Department. See "Official Notices" April 26th.

May 20th.—The Tramways Committee invites tenders for the following works required in connection with a 5,000-KW. turbo-alternator to be installed at Pinkston power station :—Iron and steel works for turbine foundation, engine-room floor, &c., and steam and water piping and valves. Mr. J. Dalrymple, general manager, 45, Bath Street.

Gloucester.—Forty-five street-lighting lanterns for high candle-power tungsten lamps, for the City Electricity Department. See "Official Notices" May 3rd.

Grimsby.—May 16th. Continuous-current motor-generator with switchboard panel, and an automatic reversible booster with switchgear, for the Corporation. See "Official Notices" April 26th.

Halifax.—May 13th. One 360-tube fuel economiser, for the Corporation Tramways and Electricity Committee. See "Official Notices" May 3rd.

Huddersfield.—May 20th. 1,000 single-phase meters, for the Corporation. See "Official Notices" May 3rd.

Italy.—ROME.—Tenders are invited for the supply and erection, at the new offices of the Ministry of Agriculture, of one elegant passenger-lift to carry four persons, fitted with two doors; two lifts to carry six persons each; a goods lift to carry 1,000 kg.; two goods lifts to carry 50 kg. each; and one lift to carry 50 kg., with electric working equipment.

Kimberworth.—May 16th. Electrical wiring at the Smallpox hospital, for Rotherham T.C. Borough Engineer.

Leicester.—May 17th. One 750-KW. single-phase motor-alternator, for the Corporation Tramways and Electricity Department. See "Official Notices" May 3rd.

Leigh.—May 13th. Telephone installation at the Union Workhouse, for the B. of G. See "Official Notices" May 3rd.

London.—May 14th. Steam coal for the Central London Railway Co.'s power house at Shepherds' Bush for six, nine or twelve months. Secretary, Oxford Circus Station, W.

June 3rd.—Battery boosters and switchboard, for the Westminster Electric Supply Corporation, Ltd. See "Official Notices" to-day.

BATTERSEA.—May 15th. Two 30-in. electrically-driven reversible ventilating fans, with controlling and reversing switches, for the B.C. See "Official Notices" to-day.

HAMMERSMITH.—May 15th. Steam traps and recording voltmeters, for the B.C. See "Official Notices" to-day.

Manchester.—May 14th. Corporation Tramways Department :—Rail bonds, trolley wire, poles, &c. Mr. J. M. McElroy, general manager.

May 15th.—High-pressure steam pipes and supports for Stuart Street generating station, for the City Electricity Committee. Mr. S. L. Pearce, chief electrical engineer, Dickinson Street.

Newcastle-on-Tyne.—May 22nd. Turbo-alternator and converting plant, for the Tramways Committee. See "Official Notices" April 26th.

New Zealand.—July 1st. Public Works Department. Supply of machinery and material for the Lake Coleridge electric power scheme. See this column in our issue of April 12th.

Nuneaton.—May 14th. Main switchboard, for the Corporation Electricity Department. See "Official Notices" May 3rd.

Rochdale.—May 22nd. Contract A 57.—Overhead line for the supply of electricity to Roch Mills sewage disposal works. Contract B 58.—Paper-insulated lead-covered, and also lead-covered and armoured cable. Specifications, &c., from Mr. C. C. Atchison, borough electrical engineer.

Rotherham.—May 18th. Two automatically-controlled electrically-driven motor and pump sets. Borough Engineer.

Salford.—May 11th. The Corporation Electricity Department is inviting tenders for a 10-ton travelling crane. Specifications, &c., from the Borough Electrical Engineer, Electricity Works, Frederick Road, Pendleton.

Spain.—May 17th. The municipal authorities of Puebla de Alcocer (province of Badajoz) are inviting tenders for the concession for the electric lighting of the town during a period of five years.

Uruguay.—MONTEVIDEO.—June 20th. Tenders are invited for the supply and erection of four electric turn-bridges of 1,500 kg. each, with 800 metres of rails, for the Customs warehouses. Terms, &c., Harbour Secretary, Calle Piedras No. 156, Montevideo.

West Ham.—June 5th. Refuse destructor and steam-raising plant in connection with the Canning Town generating station, for the Council. Specification (£1, returnable) from the Borough Engineer, Town Hall.

CLOSED.

Australia.—The *Australian Mining Standard* announces the placing of the following contracts :—

Frankton Junction (N.Z.) Town Board :—
Suction gas plant, D.C. dynamos, balancer, booster sets, &c., at rates.—Brush Electrical Engineering Co.

Napier (N.Z.) Borough Council :—
Rolling stock.—Brush Electrical Engineering Co.

P.M.G.'s Department, Melbourne :—
3 miles lead-covered, paper-insulated telegraph cable, 12 conductors, 20 lb. per mile, at £207 per mile, £621.—W. T. Henley's Telegraph Works Co., Ltd.
117 tons galvanised iron wire, 200 lb. per mile, at £11 18s. 9d. per ton, 81 tons galvanised iron wire, 400 lb. per mile, at £11 8s. 9d. per ton, £2,328.—R. Johnson, Clapham & Morris, Ltd.
Two combined Gardner oil engine and generator sets, at £283 10s. each, £567.—Noyes Bros. (Melbourne) Pty, Ltd.
Large quantities of steel spindles have been ordered from Messrs. Williams and Co., Brunswick.

Bexhill-on-Sea.—The T.C. has accepted the tender of the Brush Electrical Engineering Co., Ltd., for an electric commutator grinder, at £35.

Bootle.—In connection with the new generating station, Messrs. Joshua Henshaw & Sons, of Liverpool, have received a contract for the construction of the boiler house, engine house, weigh office and elevated roadway, at £8,399; and the tender of Messrs. Dryland & Preston, Ltd., of Littleborough, at £1,500, for the erection of the chimney shaft, has been accepted.

Amended tenders from the B.T.-H. Co., Ltd., and Messrs. A. Reyrolle & Co., Ltd., for switchgear at the new works, have been considered, and the Corporation has accepted that of Messrs. Reyrolle for high and low-tension switchgear, at £1,867. The Council has rescinded its former provisional resolution, of April 3rd, accepting the tender of the B.T.-H. Co. for low-tension switchgear, and of Messrs. Reyrolle for high-tension switchgear.

Bristol.—In connection with the proposed conversion of Southmead Workhouse into an infirmary the following contracts have been recommended :—

Electric generating plant.—The Electric Construction Co., Ltd., £1,432.
Electric fittings and wiring.—Messrs. Hancock & Rixon, £897.

Burnley.—The Corporation has accepted the tender of the British Insulated and Helsby Cables, Ltd., to supply the overhead wire required in renewing two overhead sections of the tramways, for £536. The Electricity Department has renewed the contract for 10 years with the Tudor Accumulator Co., Ltd., for the maintenance of the traction battery; the company are also to supply 28 cells for £189. Other tenders accepted are those of the British Thomson-Houston Co., Ltd., to supply electric motors and spare parts, and of Messrs. Ferranti, Ltd., to supply starters required during the next 12 months.

Burton-on-Trent.—The T.C. has accepted the tender of Messrs. Marriott & Co. for coal slack for the electricity works for a year.

The T.C. has accepted the tender of Messrs. R. Kershaw & Sons, at £1,345, for the erection of offices in connection with the electricity works extension.

Cannock.—The U.D.C. has accepted the tender of Messrs. Bumsted & Chandler, of Hednesford, for an engine and electric fittings for the new Technical Institute, at £235.

Dundee.—The following tenders have been recommended for acceptance by the T.C. Electricity Committee in connection with the new electric substation :—

Demolition and foundations.—The Yorkshire Hennebique Co.
Steel work.—Thos. Russell, Dundee.
Crane.—John Smith, Ltd., Keighley.
Converting machinery.—British Westinghouse Co., Ltd.
Switchgear.—The British Westinghouse Co. and the British Thomson-Houston Co., Ltd.

The erection and equipment and the general extension of the electrical system will cost over £6,500.

Glasgow.—The T.C.'s Tramways Committee recommend acceptance of the offer of Hadfield's Steel Foundry Co., Ltd., for spare points.

For the Whitevale depôt extension the following are included in the tenders accepted :—

Cable.—British Insulated and Helsby Cables, Ltd.
Special work.—Lorain Steel Co.

Hull.—With reference to the paragraph in our last issue, the contract for an overhead crane for the Sculcoates works has been placed with Messrs. S. H. Heywood & Co., Ltd., of Reddish, not Messrs. S. Heywood & Co.

Leyton.—The U.D.C. has received the following tenders for the supply of two miles of 2 sq. in. distributor cable :—

R. R. Todd	(accepted)	£590
Standard Cable Co., Ltd.		604
Henley's Telegraph Works		667
Aubert Grenier & Co.		670
Johnson & Phillips		670
Brit. Insulated & Helsby Cables, Ltd.	(not to specification)	670
St. Helens Cable Co., Ltd.		670
Union Cable Co., Ltd.		685
Electrical Engineering and Equipment Co., Ltd.		690
Siemens Bros. & Co., Ltd.	(not to specification)	701
General Electric Co.		770

Liverpool.—The Corporation has accepted the tender of the United Electric Car Co., Ltd., of Preston, for one double-deck single-truck car, with two staircases, segmental in form, set "reversed" at each end of the car, and one centre entrance double-deck bogie-car. These are cars of new design, the outcome of the attention given by Mr. C. W. Mallins (general manager) to the problem of simplifying the access facilities of tramcars. Both types have a special provision to prevent the inconvenience arising from persons attempting to board cars before the outgoing passengers have left. They will be equipped with the Liverpool standard braking arrangement, and also the apparatus, consisting of a balanced or spring-controlled signal arm, operated by two electromagnets energised by coils and controlled for three different positions, which gives, independent of the conductor, a definite signal to passengers on the boarding platform that the car is about to start. The Corporation has also, on the recommendation of the Tramways Committee, accepted the tender of Messrs. W. A. Stevens, Ltd., of Westminster, for two 40-H.P. "Tilling-Stevens" petrol-electric motor omnibuses, complete with tires and double-deck bodies, to seat 34 passengers each. These are to be used on one of the suburban services.

London.—SHOREDITCH.—The B.C. Lighting Committee has accepted the offer of the Electric Construction Co., Ltd., at £690, for re-winding two 100-K.W. transformers, to make them capable of being used as reducers on the new three-wire supply, and providing new commutators and brushgear. The borough electrical engineer will carry out the alteration to the field coils.

BATTERSEA.—The offer of Messrs. Babcock & Wilcox, Ltd., at £645, has been accepted by the B.C. for five superheaters for boilers at the generating station.

MARYLEBONE.—The B.C. has accepted the tenders of Mr. R. R. Todd and the Standard Cable Co. for annual supplies of underground cables.

The Titan Lift Co., Ltd., has successfully tendered to the Metropolitan Asylums Board for the installation of two electrically-controlled lifts at the Tooting Bec Asylum, for £420. Twelve tenders were received, the prices ranging from that accepted to £840.

BERMONDSEY.—At a Council meeting on Tuesday, the Electricity and Street Lighting Committee recommended that the tender of Pirelli, Ltd., be accepted for lead-covered cable, at between £200 and £300. Mr. F. Franken proposed the acceptance of the tender of the Western Electric Co., Ltd., of Woolwich, subject to an undertaking that the cable was manufactured in this country. He said that the cable of Messrs. Pirelli was made in Milan, and the reason for their low tender, which was £70 below that of the Western Electric Co., Ltd., was that the wages paid by the Italian firm were only £1 a week as against 35s. paid in this country. Mr. A. Clarke seconded. Mr. W. Pridmore held that to throw away £69 on a tender of this kind was what no business man would tolerate for a single moment. All the tenders of the English firms were over 30 per cent. higher than those of Messrs. Pirelli, and he was informed that the reason for this was that English companies were members of an association to keep up prices. No other reason had been assigned for their high prices, and it was the duty of the Council to break up these associations of manufacturers. The Council decided to accept the tender of the Western Electric Co., Ltd., at the enhanced price.

Messrs. Stothert & Pitt, Bath, have received the contract to provide 13 electric capstans at the South Lambeth goods depôt of the G.W.R.

Newcastle-on-Tyne.—The City Council has allocated contracts for tramway junctions, cross-overs, &c., to Messrs. Edgar Allen & Co., £1,220: the Titan Trackwork Co., £853; and Hadfield's Foundry Co., £2,250.

Newcastle-under-Lyme.—The Electricity Committee of the T.C. recommended the acceptance of the tender of the Diesel Engine Co., Ltd., for one 180-KW. Diesel engine (300 B.P.M.), at £2,091; a Bruce Peebles generator, at £318; a 135-KW. Diesel engine (300 R.P.M.), at £1,670; a Bruce Peebles generator, at £279; and one Little's cooler, at £231. The recommendation has been referred back to the Committee.

Sheffield.—The T.C. has accepted the tenders of Messrs. Reyrolle & Co., Ltd., at £1,682 and £397, for extra high-tension three-phase sub-station switchgear and 36 high-tension switches, respectively.

Stockport.—The Tramways Committee of the T.C. has accepted the tender of the British Westinghouse Co., Ltd., for gear wheels.

Stoke-on-Trent.—The Council has ordered for the electricity station, Hanley, mechanical stokers and self-cleaning furnaces from Messrs. Ed. Bennis & Co., Ltd. This is the second repeat order given to this firm.

Tonbridge.—The U.D.C. has accepted the following tenders for a year:—

Electrical Apparatus Co.—Motor-type meters.
Bastian Meter Co.—5-ampere electrolytic meters.
White & Co.—General Stores.
Sloan Electrical Co.—Carbons.
Western Electric Co.—Cables.
Vacuum Oil Co.—Oil.

Worthing.—The T.C. has accepted the tender of Messrs. Hughes & Stirling for additional cells at the refuse destructor, at £595.

York.—The Electricity Committee has accepted the tender of Messrs. Babcock & Willcox, Ltd., at £5,200, for extensions to boiler-house plant at the generating station.

Wimbledon.—The following tenders have been accepted by the T.C.:—

Compounds.—Dussek Bitumen Co.
Tapes, &c.—British Insulated and Helsby Cables, Ltd.
House-service boxes.—W. Lucy & Co., Ltd.
Main joint-boxes and lead sleeves, and joint-box fittings.—W. Lucy and Co., Ltd.
House fuse-boxes.—Sykes & Sugden, Ltd.
Frames and covers.—Callender's Cable and Construction Co., Ltd.
Transformers.—British Electric Transformer Co., Ltd.
Lamps, and V.I.R. cables and accessories.—General Electric Co., Ltd.
Arc lamp globes.—E. J. Shaw & Co.
Flame arc lamp carbons.—Giepel & Co.

FORTHCOMING EVENTS.

Physical Society.—Friday, May 10th. At 8 p.m. At the Imperial College of Science, South Kensington, S.W. Papers on "A Method of Measuring Small Inductances," by Mr. S. Butterworth; "The Conversion of Starch into Dextrin by X-rays," by Messrs. H. A. Colwell and S. Russ; "Calibration of Wave-Meters for Radio-Telegraphy," by Prof. G. W. O. Howe; and demonstration of "Apparatus for Showing the Generation of Electricity by Carbon at High Temperatures," by Messrs. J. A. Harker and G. W. C. Kaye.

Junior Institution of Engineers.—Friday, May 10th. At 8 p.m. At the I.E.E. Paper on "Notes on Telephone Exchange Equipment," by Mr. A. J. Hayes.
Friday, May 17th.—At 8 p.m. At 39, Victoria Street, S.W. Paper on "Storage Battery Engineering," by Mr. G. C. Allingham.

Institution of Mechanical Engineers (Graduates' Association).—Monday, May 13th. At 8 p.m. Discussion on "Steam and Electricity for Railway Traction."

Royal Society of Arts.—Monday, May 13th. At 8 p.m. Howard Lecture on "Heavy Oil Engines," by Capt. H. Riall Sankey. (Lecture III.)
Wednesday, May 15th.—At 8 p.m. Paper on "The Manufacture of Nitrates from the Atmosphere," by Mr. E. Kilburn Scott.

Institution of Electrical Engineers (Scottish Local Section).—Tuesday, May 14th. At 8 p.m. At 207, Bath Street, Glasgow. Annual general meeting. Paper on "Power Generation and Distribution in the Clyde Valley Electrical Power Co.'s Area," by Mr. D. A. Starr.

Institution of Electrical Engineers (Yorkshire Local Section).—Wednesday, May 15th. At 7.30 p.m. At the University, Leeds. Annual general meeting.

Institution of Electrical Engineers (London).—Thursday, May 16th. At 7.45 p.m. Annual general meeting. At 8.30 p.m. Ordinary meeting. Paper on "Condensers in Series with Metal-Filament Lamps," by Mr. A. W. Ashton. Presentation to the Institution of a bust of the late Lord Kelvin.

Royal Institution.—Friday, May 17th. At 9 p.m. Discourse on "High-Frequency Currents," by Mr. W. Duddell.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week:—

Monday, May 13th.—"A" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Tuesday, May 14th.—"B" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Wednesday, May 15th.—All Companies. Annual course of musketry at Purfleet. All instructions and railway tickets will be sent to members notifying the O.C. if they can attend on this date.

Thursday, May 16th.—"C" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Friday, May 17th.—"D" Company. Infantry drill, 7.30 to 8.30 p.m. Technical work, 8.45 to 10 p.m.

Recruits' instruction will be continued on Tuesdays and Fridays for al those not passed out by the Adjutant.

Saturday, May 18th.—Annual course of musketry at Purfleet. Instructions for, see detail for Wednesday, May 15th. Headquarters will be open for regimental business from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

Fatality.—At Chopwell Colliery, County Durham, a hewer, named John Hudson, aged 25, was killed on the 3rd inst. At the inquest, George Wallace, another hewer, said that on Friday morning Hudson went from the "coal face" to the switch-box, which had gone wrong. Deceased, who knew there was a "finger" broken, and said he thought he could put it right, lifted the cover up and put it down again, and then shouted to the boy near the main switch to switch the current on. The deceased then became fast to the lever of the switch-box. Witness shouted to the boy to shut the current off, and as soon as this was done Hudson fell. Artificial respiration was unavailing. In reply to Mr. Atkinson, Inspector of Mines, witness said the workmen had not been told not to attend the motors. The deceased had often done that work. James Wills, a deputy-overman, said if there was anything wrong with the motor switch-box, the electrician ought to have been sent for. It was not part of deceased's duties. John Morland, electrician, said the switch-box was not earthed. The cables were put down the pit before the rules, read by Mr. Atkinson, came into force, therefore they were exempt. If the switch-box had been earthed, the deceased would not have been killed. The Miners' Inspectors suggested that all switch handles should be covered with insulating material. The jury found that the deceased had been accidentally killed by electric shock.

NOTES.

Conversazione of the Arc Works Engineering Society.—This Society held its fifth annual conversazione on Friday, May 3rd, 1912. The entertainment took place in the Arc Works Club House, Writtle Road, and there was a large attendance of members and their friends. Col. Crompton wrote expressing his regret at being unable to be present, and in his absence the chair was taken by Mr. A. J. Hodgson, works manager, who, during the evening, presented premiums to Messrs. Edward Hughes and F. H. Foxlee, who, as apprentices at Messrs. Crompton & Co., had contributed the best papers to the Society during the last session. A new departure was made on this occasion, the Society's invitation being extended to ladies, and the success of the entertainment showed that the innovation was much appreciated. An opportunity given for the examination of the various experiments and scientific exhibits, which were provided in the building. The musical programme was of great interest, and it was here that the admission of ladies proved of the greatest gain, the audience very much appreciating the contributions of Miss Ethel Waumsley, Miss E. Matthewson and Miss Eva Hodgson. Violin solos were played by Mr. Gatehouse, who was admirably accompanied on the pianoforte by Miss Evelyn Thornton. The programme was varied with recitations by Mr. W. E. Warrilow, and the very clever conjuring of Mr. J. B. Knight, and the audience was kept perfectly happy by the very humorous singing of Mr. Percy Phillips. A novel item in the programme was provided by Mr. Edward Hughes, who sang a Welsh song, entitled "Brenddwyd-y-Freuhines" (The Queen's Dream). Miss Eva Hodgson, Miss Ethel Waumsley and Mr. G. L. Williamson provided a trio for piano, violin and 'cello, Mr. A. G. Collis contributed two songs, and Mr. C. W. Shepherd was the Society's accompanist. The evening closed with a vote of thanks to all those who had contributed to the success of the entertainment. Mr. C. Lucy and the hon. secretaries are to be congratulated on the result of their efforts.

Electricity Supply Rifle League.—The following are the results of the matches shot during April in connection with this League:—Westminster, 568, *v.* Central, 545; Westminster, 565, *v.* Stepney, 545; Central, 555, *v.* Hackney, 540; Central, 568, *v.* Shoreditch, 554. The following is the position of clubs to date:—

Club.	Matches. Shot.	Won.	Lost.	Points.	Scores. For.	Against.
Central	3	2	1	4	1,668	1,662
Westminster ...	2	2	0	4	1,133	1,090
Shoreditch ...	1	0	1	0	554	568
Stepney	1	0	1	0	545	565
Hackney ...	1	0	1	0	540	555
Ilford	0	0	0	0	0	0

Melbourne Railways Electrification. — A correspondent writes:—

"I have seen with great interest the advertisement in your columns, of the tenders which are being called for by the Government of Victoria in connection with the electrification of the Melbourne Railways.

"It is much to be regretted that as comparative tenders are being asked in connection with continuous and single-phase systems, that items have been left out which will vitiate the comparison between the two systems.

"No specifications have been issued either for transmission or distributing lines, or for the contact line.

"It is well known that the American and German upholders of the single-phase system state, that in these three items the single-phase system is superior to the continuous current.—A LOOKER-ON."

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM LOCAL SECTION).—The Committee has prepared the following list of officers to act during the Session 1912-13:—

Past Chairmen—Gisbert Kapp, R. K. Morcom, M. Railing.
Chairman—A. M. Taylor.
Vice-Chairmen—C. E. C. Shawfield; W. E. Sumpner, D.Sc.
Present ordinary Members of Committee (remaining in office)—W. C. Goodchild; M. L. Kahn; W. J. Larke; F. M. Lea; D. K. Morris, Ph.D.; M. Solomon; R. Threlfall, F.R.S.
Ordinary Members of Committee (new nominations)—G. Barnard; J. F. Lister; A. Railing; F. W. Schiller; T. F. Wall.
Hon. Secretary—H. B. Matthews.

New nominations have to reach the Hon. Local Sec. (H. B. Matthews, Winchester House, Victoria Square, Birmingham) by May 15th. The annual general meeting will be held at the Grand Hotel on Wednesday, May 22nd, at 7 p.m.

ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTIONS.—The annual conference of the Association will be held at Whitsuntide in London, at the Polytechnic, Regent Street. A paper will be read by Sir Alfred Keogh, K.C.B., on "The relations between the Imperial College of Science and Technology and Technical Institutions," and there will be a discussion on the important question of the co-operation of Employers in Technical Education. A paper on this subject will be read by Mr. E. A. Atkins.

VICTORIAN INSTITUTE OF ELECTRICAL ENGINEERS.—The annual meeting of the Institute was held last month, when Mr. J. H. D. Brearley was elected president, and Prof. Payne and Mr. W. J. Newbiggin, vice-presidents. It was reported that the membership amounted to 150.

INSTITUTION OF ELECTRICAL ENGINEERS (NEWCASTLE LOCAL SECTION).—To-morrow the members of this Section, together with members of the North of England Branch of the Association of Mining Electrical Engineers, go for their second excursion of the session. The first took place in February, to Darlington. To-morrow's visit will be to some of the largest and most important steel and iron works and waste-heat power stations in the Middlesbrough district. Lunch is to be served at the Corporation Hotel at 1.30 p.m., and in the afternoon the President of the Local Section will deliver an address, and a discussion will follow on the possibility of forming a Sub-Section of the I.E.E. in Middlesbrough, or of adopting other means of increasing the utility of the technical societies to residents in Middlesbrough, Cleveland and Darlington districts. Thus, it will be observed, the Section is not satisfied with looking after the interests of its own members, but is in a very excellent way trying to popularise the Institution. The evening will be spent socially with the Cleveland and Durham power station staff, who have invited the party to tea. On Saturday last the students of the Newcastle Section paid a visit to the Harton Colliery.

ROYAL INSTITUTION.—The Friday evening discourse, on May 17th, will be delivered by Mr. W. Duddell, on "High-Frequency Currents."

INSTITUTION OF ELECTRICAL ENGINEERS (NEWCASTLE STUDENTS' SECTION).—The first annual report states that at a special meeting of Students and their friends on December 15th, 1911, it was unanimously agreed to form a Students' Section in Newcastle. Eight general meetings were held in the Armstrong College, at which papers were read and discussed. The total number of Students of the Newcastle Section is 151, and the average attendance at general meetings has been 54. Mr. B. A. Robinson has been elected chairman of Committee for the session 1912-13, and Mr. T. C. Christianson, vice-chairman. The hon. secretary is Mr. T. E. Bridge, 31, Simpson Street, Newcastle-on-Tyne.

INSTITUTION OF ELECTRICAL ENGINEERS (MANCHESTER SECTION).—The annual meeting of the Section was held on the 30th April, when the annual report was read and approved. Mr. J. S. Peck proposed a vote of thanks to Mr. Cramp, who as chairman had experienced a strenuous year of office. Mr. W. Cramp in responding said the session had been an arduous one, not for him alone, but for the whole Committee. A large amount of additional work had had to be done in connection with the new Articles of Association. He suggested that they might have one meeting next session where an exhibition of the domestic uses of electric cooking apparatus could be held and ladies might be present. A vote of thanks was accorded to Mr. J. Frith for his services as Hon. Sec. Mr. A. A. Day was elected chairman; Professor E. W. Marchant and Dr. E. Rosenberg, vice-chairmen, and Mr. Julius Frith, hon. secretary and treasurer. Other members of Committee are: Prof. Miles Walker, Messrs. K. Faye-Hansen, Ll. Foster, H. J. Hawkins, E. L. B. Hill, G. Layton, E. M. Hollingsworth, A. E. McKenzie, T. L. Miller, B. Welbourn, P. P. Wheelwright and F. H. Whysall.

INSTITUTION OF ELECTRICAL ENGINEERS (STUDENTS).—A Students' meeting was held in Birmingham, on May 2nd, Mr. A. M. Taylor presiding. A discussion was held on "D.C. *v.* A.C. for Traction Purposes," which was opened by two papers, Mr. L. H. A. Carr outlining the chief advantages of the D.C. high-tension system, and Mr. C. H. Goulden upholding the A.C. single-phase system. An interesting discussion took place. It may be pointed out that this was the first meeting exclusively for students that has been held in Birmingham, and it is hoped that in future such meetings may be held regularly.

INSTITUTION OF CIVIL ENGINEERS.—It is announced that in order to avoid interference with the ordinary work of the Institution, the removal of the contents of the present building in Great George Street, S.W., and the internal fixtures and structural fittings will be proceeded with early in the recess. The library is to be stored in the lower ground floor pending the construction of the new building, and it is expected that some of the rooms will be ready for occupation by the end of this year, so that the library books may be then rendered available and the reading room reopened. It is hoped that the new premises may be brought into partial use in the early part of 1913 and completed for occupation some months later. Correspondence should be directed to 12, Dartmouth Street, S.W., where temporary offices have been taken for the accommodation of the staff and meetings of the Council and its committees.

INSTITUTION OF ELECTRICAL ENGINEERS (SOUTH AFRICA).—At a meeting of the Local Section of the Institution on April 11th, at the South African College, Cape Town, the Chairman for the ensuing year (Mr. Walter F. Long) delivered an address, which took the form of a description of electric lighting developments in Cape Town and suburbs from the first installation in 1882 by the Brush Co., to the present time. Practically all the earlier installations have been discarded in favour of a supply by the Corporation from its Dock Road power station.

ASSOCIATION OF MINING ELECTRICAL ENGINEERS.—At a meeting of the West of Scotland Branch of the Association at Glasgow, Mr. Matthew Brown, general manager of the Banknock Coal Co., was elected president, and Mr. A. B. Muirhead (Lenzie) vice-president. The total membership of the branch, it was announced, stood at 180. A paper contributed by Mr. James Gillespie, of the East of Scotland Branch, on "The Operation of Electrical Apparatus in Mines by Remote Control," was read and discussed. Mr. Robert W. Peters (Lochgelly) recently read a paper on "Earthed and Insulated Neutrals in Colliery Installations." The author stated that he favoured the earthing of the neutral, after 16 years' experience in mining electrical work, both on high and low-tension three-phase plants, and on large direct-current insulated systems. He strongly advocated the earthing of the neutral at one

point and through a suitable resistance in all cases of three-phase supply. He believed in having armoured cables throughout, and the motor frames, switch boxes, joint boxes, gate ends, and the like thoroughly bonded and earthed to the same.

At a meeting of the NORTH OF ENGLAND GAS MANAGERS' ASSOCIATION, on May 4th, in Newcastle-on-Tyne, Mr. Jacques Abady delivered a lecture on "Light and Competition." He said that with gas as it was made now, and burners as at present designed, he did not think there was very much possibility of greatly improving the service that could be obtained from a cubic foot of gas. Electricity, on the other hand, was hot-foot in pursuit of an idea, that was using vapour as a conductor, which he thought would, in, perhaps, the near future, be productive of great results. He claimed that the gas man had little to fear from the electrician in the matter of cost. He had recently attended an experiment with a new form of gas lighting, the introduction of which, he thought, would do as much for gas as the metal-filament lamp had done for electricity.

Appointments Vacant.—Improver operators (Irishmen only) for the Provincial Cinematograph Theatres, Ltd. (30s.); cost clerk, buyer for raw material, and a test-room assistant, for the Phœnix Telephone and Electricity Works, Ltd. See our advertisement pages to-day.

Catalogues Wanted.—A trader in Ontario, Canada, wants catalogues and prices of British-made telephone apparatus. Apply for name to Board of Trade Commercial Intelligence Branch, London.

Inquiries.—A correspondent asks for particulars of the "Star" system of regeneration, as applied to rolling mills, &c. Makers of the Permutit electric water-softening plant, and the "Whisperphone," are asked for.

Educational Notes.—IMPERIAL COLLEGE OF SCIENCE.—In the course of a series of lectures on rubber, by Mr. Herbert Wright, at the Imperial College of Science, South Kensington, the lecturer stated that the rubber plantations in Ceylon had grown from 300 acres in 1890 to 220,000 acres to-day, and in Malaya from 350 acres in 1897 to 400,000. Including financial corporations, over £90,000,000 had, in Great Britain alone, been ear-marked for rubber plantation from 1906 to the end of 1911. Ceylon, India and Malaya headed the list with £45,000,000, and this money had, so far, given us about 100,000,000 rubber plants under cultivation.

He stated that the highest yield of latex from a single tree was 480 lb. in two years, this giving 160 lb. of dry rubber. The range in thickness of the bark shavings cut away at each tapping operation was too great; where the bark had been cut away too rapidly, the percentage of caoutchouc in the latex seriously diminished.

In the sixth of the special series of lectures on rubber, Dr. Philip Schidrowitz dealt with the chemical and physical properties of crude rubber. He said it had not yet been definitely ascertained whether the nitrogenous "insoluble" matter, which was present in considerable quantities in some rubbers, did not play some important part in regard to quality. There appeared to be an important connection between the viscosity of a rubber solution and the strength of the material.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements*

Central Station Officials.—MR. NORMAN BROOKSBANK, engineer-in-charge at the Leicester Corporation tramways power station, was, on the occasion of his marriage, which took place on April 20th, presented with a cake basket and tea-tray from the staff and employés. The presentation was made by Mr. T. R. Smith, the chief engineer.

The Bury (Lancs.) T.C. has increased the salary of MR. J. G. POTTS, works superintendent at Chamber Hall power station, from £2 10s. to £3 per week.

MR. A. H. SMITH, charge engineer at the Whitehaven Corporation electricity works, has been appointed to a similar position at the Crewe electricity works.

On Tuesday last MR. B. DRANE, who recently occupied the position of mains superintendent to the electricity supply department of the South Metropolitan Electric Tramways and Lighting Co., Ltd., was the recipient of a silver demi-hunter watch, presented to him by his late colleagues to mark the occasion of his leaving to take up an appointment with the Marylebone Corporation. The presentation was made by the general manager, Mr. A. V. Mason.

The marriage took place at Blackpool last week of MR. CHAS. J. MELBOURNE, chief assistant electrical engineer to the Burton-on-Trent Corporation, and Miss Florence White, of Blackpool. The presents included silver servers for the bride from the employés of Blackpool electricity works, and an oak clock from the employés of the Burton works.

A Cape Town correspondent says that the city electrical engineer of Cape Town (MR. W. F. LONG) left for England by the Mail boat on April 17th, in connection with the purchase of additional plant required by the Corporation for the extensions of electrical energy to the municipalities in the southern suburbs of Cape Town

The Walthamstow Council has increased the salary of MR. W. H. TAYLOR, assistant electrical and tramways engineer, from £210 to £260 per annum.

The appointments of MESSRS. B. HAWKINS and H. SIMPSON referred to in our last week's issue, are under the *St. Helens* Electricity Committee, not Wakefield. We regret the error.

MR. H. HODGES has resigned his appointment at Mansfield, to take up the duties of assistant engineer at Nuneaton.

General.—MR. F. L. N. TUCK, A.C.G.I., B.Sc. (Eng.), whose appointment as chief instructor in Physics and Electrical Engineering in the Seddon Memorial Technical College, Auckland, N.Z., has just been announced, sails for the Antipodes on May 11th. After obtaining the diploma of A.C.G.I. at the Central Technical College in 1905, Mr. Tuck served an apprenticeship with the British Westinghouse Co., Manchester, and had subsequent experience with Messrs. Reyrolle & Co., of Hebburn-on-Tyne. For the past year he has been engaged in the foreign department of the A.E.G. in Berlin.

MR. A. PODMORE, assistant engineer to the Constantinople Telephone Co. (Société Anonyme Ottomane des Téléphones de Constantinople) left London on Tuesday, April 30th, to take up his duties in Constantinople.

The *Review of the River Plate* states that MR. D'ABBADIE D'ARRAST has resigned the post of general manager of the Cordoba Electric Light and Power Co., to take a seat on the London board of directors. Mr. D'Abbadie has been manager of the company since 1899. MR. G. LEWIS, of the firm of Messrs. J. G. White and Co., has been appointed manager. Mr. Lewis has had charge of the additions recently made to the power house, and also of the electrification of the tramways which belong to the company.

MR. HARRY J. BOOKER is taking up the appointment of manager of the sales department for Messrs. Scholey & Co., Ltd., and is leaving Messrs. J. & H. Grevener, with whom he has been associated for a number of years.

MR. J. KING, electrical engineer, who is leaving the service of Messrs. Eagleston & Son, electric wiring contractors, of Oxford, with whom he has been for 10 years, was last week presented with a smoker's cabinet at a smoking concert arranged by the employés.

Last Saturday evening at the Restaurant Frascati, the departmental managers and representatives of the Electrical Co., Ltd., entertained MR. O. SCHACHERT, their general manager, to dinner, on the occasion of his departure for South America to take charge of the A.E.G. interests there. Mr. Loewi, the company's secretary, occupied the chair, and voiced the feelings of all present in a speech well worthy of the occasion, and made the presentation, which took the form of a dressing case. He was ably seconded by Mr. Schachert's successor, Dr. Koch. Mr. Schachert, in saying farewell, called upon the staff to render to his successor the same loyal support that they had given him in the past. After the speeches, many songs and musical items were rendered, and the evening concluded with the singing of "Auld Lang Syne."

Obituary.—MR. JOHN GRAY, B.SC.—The death of Mr. John Gray, which we mentioned briefly in our last issue, removes from our midst, at the age of 58 years, a gentleman who was highly esteemed by many with whom he had become associated in the scientific world, by reason of his quiet and unfailing good humour and the originality and excellence of his work in certain departments of research. Some 38 years ago in Aberdeen, Mr. Gray was one of a brilliant band of Whitworth scholars, and while employed in the same engineering works as Mr. W. B. Esson he was, at night, engaged as a lecturer on "Applied Mechanics and Steam" at the Aberdeen Mechanics Institution. Shortly afterwards (in 1874), Mr. Gray and Mr. Esson left Aberdeen together for London, the former as a Royal Exhibitioner to be three years at the Royal School of Mines, the latter as a teacher in training, to attend lectures at the Normal College of Science. After his course at the School of Mines was ended and he had obtained his A.R.S.M., Mr. Gray entered the Patent Office in London as an indexing and abridging clerk under a new *régime* then beginning. At the time of his death he was still in the Patent Office service, having risen to a very responsible position as Examiner, where he specialised largely in patents connected with electrical matters. For very many years past, we believe getting on for 20, he had been a regular and valued contributor to the pages of the ELECTRICAL REVIEW. Physics, Röntgen rays, wireless telegraphy, atmospheric electricity, atomic and electronic theories—these were a few of the subjects in which he took an interest, while his name is known to many by reason of his excellent little book published years ago on "Influence Machines." For some time past the deceased gentleman had devoted a tremendous amount of time to anthropological pursuits. Into these he threw himself with an immense enthusiasm and a zeal that spoke of a deep conviction. One effect of his development along this line of study was that Section A (Mathematical and Physical Science) of the British Association, which once knew him so well, no longer "held" him, the new love of the Anthropological Section, in which he was a very active member and read many reports and papers, winning him away. Mr. Gray was treasurer of the Anthropological Institute. During the early months of this year he was unwell and went abroad for a change. He was in these offices only a few weeks before his death, and though he had not fully recovered his former health, the news of his death from pneumonia—doubtless contributed to by the keen and biting winds of last month—came to us, as it must have done to his many friends, as a shock. The funeral took place at the Necropolis, Woking, on May 2nd. We desire to tender to his widow our deep and sincere sympathy in her bereavement.

NEW COMPANIES REGISTERED.

Callender's Share and Investment Trust, Ltd. (121,778).—Registered May 3rd, by Drake, Son & Parton, 24, Rood Lane, E.C. Capital £200,000 in £1 shares. Objects: To acquire, hold and deal with stocks, shares, debentures, debenture stocks, bonds, obligations and securities of any company, Government or other body, and to adopt an agreement with Callender's Cable and Construction Co., Ltd. (vendors). The signatories are:—T. O. Callender, Hamilton House, Victoria Embankment, E.C., engineer, 100 shares; E. W. Fradgley, 10, Throgmorton Avenue, E.C., stockbroker, 100 shares; C. H. McEuen, 97, Cannon Street, E.C., merchant, 100 shares; J. Varley, 11, Stanley Gardens, Kensington Park, W., gentleman, 100 shares; W. Allnutt, 5, Lime Street, E.C., accountant, one share; C. W. Clark, Ellesmere, Nightingale Square, Balham, S.W., clerk, one share; N. H. Busson, 83, Cheshunt Grove, New Malden, clerk, one share. Minimum cash subscription, seven shares. The first directors (to number not less than three or more than seven) are T. O. Callender, E. W. Fradley, C. H. McEuen, and J. Varley; qualification, £100; remuneration, £100 each per annum. Registered office, Hamilton House, Victoria Embankment, E.C.

Orford Electric Light and Power Co., Ltd. (121,711).—This company was registered on April 30th, with a capital of £1,000 in £1 shares, to carry on the business of an electric power, light and supply company. The subscribers (with one share each) are:—H. T. Harrison, 11, Victoria Street, S.W., electrical engineer; S. T. Bacon, 60, Cumberland Road, Acton, W., clerk; T. D. Dymond, 23, Davies Street, W., engineer; W. Riggs, 23, Davies Street, W., engineer; H. M. Andrews, 54, New Broad Street, E.C., C.A.; H. I'Anson Jones, 51, Curzon Road, Muswell Hill, N., solicitor; W. G. C. Masham, 54, New Broad Street, E.C., secretary. Minimum cash subscription 200 shares. The number of directors is not to be less than two or more than five; the first are H. T. Harrison and W. Riggs. Registered by Jones, Son & Andrews, 54, New Broad Street, E.C.

Galsworthy Otovacum, Ltd. (121,705).—This company was registered on April 30th, with a capital of £50 in £1 shares, to carry on the business of art metal workers, manufacturers of and dealers in electrical fittings and accessories, electricians, engineers, &c., and to take an assignment of an agreement between the Vacuum Engineering Co., Ltd., and Galsworthy, Ltd. The subscribers (with 10 shares each) are:—S. S. Galsworthy, 6, Brunswick Gardens, Kensington, W., electrical engineer; M. H. Galsworthy, 12, Ornan Road, Belsize Park, N.W., electrical engineer. Private company. Table "A" mainly applies. Registered office, 15-16, Newman Street, W.

T. H. Cubey, Ltd. (121,692).—This company was registered on April 29th, with a capital of £1,000 in £1 shares, to take over the business of electrical engineers carried on by T. H. Cubey and A. Cubey as T. H. Cubey and Co. The subscribers (with one share each) are:—T. H. Cubey, 22, Pollard Street, South Shields, electrician; A. H. Cubey, 25, Osborne Avenue, South Shields, insurance broker. Private company. The numbers of directors is not to be less than two or more than five; the first are T. H. Cubey and A. C. Cubey; qualification, £25; remuneration as fixed by the company. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

CITY NOTES.

Dudley, Stourbridge and District Electric Traction Co., Ltd.

THE annual meeting of this company was held at the Electrical Federation Offices, Kingsway, W.C., on May 2nd, under the chairmanship of Mr. S. R. Blundstone.

The CHAIRMAN, in moving the adoption of the report, said there was nothing in the accounts which called for any special explanation. The receipts showed an increase over the previous year of £2,900 and the expenses had increased by £350. Administration and general expenses showed a reduction of £200, and repairs and maintenance charges were less by £1,200, due to the heavy amounts expended on repairs and rolling stock in 1910. The power and running expenses had increased by £1,750, due to the increased car-mileage run, and also to the 1910 accounts having received the benefit of 18 months' reduction in the price paid to the Dudley Corporation for electrical energy under the recent arbitration. £1,000 had been credited to the renewals account out of profits, as against £600 in the previous year. A total amount of £470 was charged against that account during the year, and it now showed a credit balance of £4,128. The net result of the year's working was, that after paying the dividend on the preference shares and placing £1,000 to renewals, and adding the balance brought forward from last year, there was a distributable balance of £3,353 6s. 10d. Subject to the approval of the shareholders, the directors proposed to devote £1,800 to the writing out of the balance of cost of the Arbitration proceedings with the Dudley Corporation; to place £1,000 to depreciation and reserve account; to put £450 to the sinking fund; and to carry the balance of £103 forward. They paid £1,800 a year for rates, and it was expected that, as the result of a recent legal decision, that amount would be substantially reduced. The coal strike did not affect the company, for the service was unrestricted, and the receipts were maintained. The management by the Birmingham and Midland Joint Committee would be continued for another year, as the joint working of the companies operating in the Black Country enabled greater economies to be obtained. The better results of the year's working were generally due to the improved state of trade in the Black Country, and with a continuance of the trade revival, he hoped the results for the present year would show still further improvement.

MR. ALLEN seconded the motion, which was carried without discussion.

Great Northern Telegraph Co., Ltd., of Denmark.—The paragraph published in our last issue regarding the dividend declaration of this company was incorrect. As announced on page 595 of our issue of April 12th, the total distribution was 18 per cent. for the year 1911.

Held Over.—Heavy pressure upon our space compels us to hold over a number of "City" matters until next week.

The Austrian Bergmann Works.—It is stated that previous to the arrangements made between the Bergmann Electricity Works Co., of Berlin, and the Siemens-Schuckert Works, for the financial participation, as was recently announced, of the latter in the former, negotiations had taken place with the Anglo-Austrian Bank in regard to the financing of the Austrian Bergmann Works, of Bodenbach. These have now led to the conclusion of an agreement in respect of all points of detail, whereby the bank is authorised on the basis of the next balance-sheet to form a limited company to take over the Bodenbach Works, the share capital to be from £250,000 to £291,000. A draft scheme of the relations to exist between the new company and the parent company in Berlin has also been arranged. The final adoption of the agreements depends upon the sanction of the new board of directors to be elected at the forthcoming meeting of the German Bergmann Co.

Eastern Telegraph Co., Ltd.—The directors report that for the six months ended December, 1911, the revenue amounted to £729,470, from which are deducted £245,387 for the ordinary expenses, and £37,461 for expenditure relating to maintenance of cables, sundry differences in exchange, and income-tax payable abroad, leaving a balance of £446,621, plus £49,048 brought from the preceding account, making a total available balance of £495,670. After providing for income-tax payable in England, interest on mortgage debenture stock, and dividends on the preference stock, which in all absorb £81,787, there remains a balance of £413,882, out of which the directors have placed £210,000 to the general reserve fund, and have paid an interim dividend of 1¼ per cent. on the ordinary stock, amounting to £50,000. The directors now recommend a final dividend on the ordinary stock of 1¼ per cent. and a bonus of 2 per cent., amounting together to £130,000, both payable on May 15th, free of income-tax, and making, with the three previous payments on account, a total distribution of 7 per cent. for the year ended December 31st, 1911. It is proposed to carry forward the balance of £23,882. The directors allude to the death of the Marquess of Tweeddale, K.T., who had been a director of the company since its formation. The Right Hon. Frederick Huth Jackson has been appointed to the board.

Western Telegraph Co., Ltd.—The directors' report for the half-year ended December 31st, 1911, states that the revenue for this period amounted to £430,572, and the working expenses to £158,022. After providing £16,373 for debenture stock interest, and £7,874 for income-tax, there remains £248,302, plus £4,390 brought forward from June last, making a total of £252,691. First and second interim dividends, amounting to £62,379, have been paid, and after transferring £150,000 to the general reserve fund, and £10,000 to the land and buildings depreciation fund, there remains £30,312, which is carried forward.

Stock Exchange Notices.—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

Consolidated Gas, Electric Light and Power Company of Baltimore.—Further issue of $1,000,000 general mortgage 4½ per cent. 30-year gold bonds of $1,000 each (Nos. 9,983 to 10,082, 10,233 to 10,582 and 11,017 to 11,516).

Puebla Tramway, Light and Power Co.—Fully-paid scrip for $3,000,000 prior lien 5 per cent. 50-year gold bonds.

Waste Heat and Gas Electrical Generating Stations, Ltd.—Further issue of 160,000 shares of £1 each, fully paid (Nos. 160,001 to 320,000).

Prospectus.—*Victoria Falls and Transvaal Power Co., Ltd.*—There are being offered for sale by Messrs. Emile Erlanger and Co. (the list closes to-day) £1,000,000 5½% second mortgage debentures (series A) at 96 per cent. There are already issued £3,000,000 five per cent. first mortgage debentures. The proceeds are to provide additional facilities for supplying power contracts that have been already booked. It is estimated that within twelve or eighteen months when these orders are supplied, there will be an annual profit of £660,000 per annum. In a page "write up" with illustrations appearing in the *Times* Financial Supplement the day before the publication of the prospectus, the central picture is a view of the Victoria Falls. The letterpress, however, states that this great asset (a preferential right to develop 250,000 electrical H.P. at the Falls for 75 years from December, 1906) remains for future exploitation.

West London and Provincial Electric Supply Co., Ltd.—The directors' report for 1911 states that the revenue of the company is derived from the dividends on the shares of the Chiswick Electricity Supply Corporation, Ltd., which the company owns, from the fees charged for managing the business of the Corporation, and from commission for acting as engineers in respect of additions to the Corporation's plant and machinery. The accounts of the Chiswick Corporation show, says the *Financial Times*, after paying interest on the first mortgage debenture stock, a profit of £3,763. Out of this the directors propose to carry £620 to depreciation reserve fund, and to pay a dividend at the rate of 5 per cent. per annum on its shares. This will be received in due course by the company, whose accounts show a balance at the credit of profit and loss account of £2,947. The directors propose to apply the above balance of £2,947 to the payment of a dividend on the cumulative preference shares at the rate of 6 per cent. per annum for the year.

West India and Panama Telegraph Co., Ltd.—The directors last week announced a dividend of 1s. per share on the ordinary shares, free of tax. This compares with 1s. 6d. per share a year ago.

Calcutta Electric Supply Corporation, Ltd.—The number of units delivered to consumers during the four weeks ended March 29th, 1912, were 854,021, compared with 658,729 units in the corresponding four weeks of 1911.

British Westinghouse Electric and Manufacturing Co., Ltd.

THE twelfth annual report for the year ended December 31st, 1911, reads as follows :—The increase in the volume of business referred to in the report for 1910 has been more than maintained, and the results of the year's trading, notwithstanding the continuance of severe competition, again show an appreciable advance. The trading, &c., profits amount to £126,144, from which fall to be deducted :—Depreciation on machinery, plant, tools, &c., £30,868 (in addition to £6,100 included in reserve for general depreciation) ; expenses on surplus land and buildings, £4,254 ; interest on 6 per cent. prior lien debentures, £14,016 ; interest on 4 per cent. mortgage debenture stock, £49,654, leaving a balance of £27,352. From this balance has to be deducted the amount required for the prior lien redemption fund, £5,984 ; proportion of expenses of issue of prior lien debentures, £660, leaving a net profit for the year of £20,708, plus £5,117 balance brought forward, making £25,825 to the credit of profit and loss account, which it is proposed should be carried forward.

"The directors alluded in their last report to the pending proceedings between the company and the Underground Electric Railways Co. of London. They regret to say that the appeal to the Lords Justices was unsuccessful. Counsel have advised appeal from their judgment, and, having regard to the sum involved, it has been decided to carry the case to the House of Lords. No provision has been made in the accounts now presented for the loss which may ultimately result. There is bound to be some loss, which will be dealt with when the amount is definitely ascertained. Last year the chairman, in his address to the shareholders, referred to the closing down of the steel foundry. As a consequence of this, the plant has since been sold at a loss of £36,720. This amount, however, is more than covered by the reserves for depreciation appearing in the balance-sheet, and amounting £51,912. The steel foundry premises are now being utilised for other manufacturing purposes. Revenue has again been charged during the year with a substantial amount for the maintenance of buildings, machinery and plant, in addition to which a sum of £30,868 has been applied to the depreciation of the same items. Orders received during the year are slightly in excess of 1910, both the home and the export markets showing improvement. This improvement is being fully maintained during the current year. But for the railway strike in August last, your directors believe that a still larger increase in orders might have been obtained, and there is no doubt that the actual output from the works was adversely affected by the strike. Your board deeply regret to have to record the death of Mr. Robert Mather, the chairman of the American company, whose relations with your board were always most cordial."

The annual meeting was called for yesterday (Thursday).

Kidderminster and District Electric Lighting and Traction Co., Ltd.—The directors' report states that the gross receipts for 1911, including the dividend on the shares held by this company in the Kidderminster and Stourport Electric Tramway Co., amounted to £10,330, plus £122 brought forward, making £10,453, compared with £9,686 for 1910. After deducting all expenses (including debenture stock and other interest), amounting to £5,590, there remains an available balance of £4,862. The directors propose to deal with this as follows, viz. : Depreciation and renewals fund, £1,250 ; debenture and loan redemption reserve, £250 ; dividend on cumulative preference shares for the year, £1,500 ; dividend at the rate of 3 per cent. per annum on the ordinary shares, £1,410 ; carry forward £452. The gross receipts of the Kidderminster and Stourport Electric Tramway Co. amounted to £6,412, an increase of £369, and the expenses, before providing for renewals, to £3,449, an increase of £160. The profit on the year's working, after providing for renewals, is £2,090, plus £166 brought forward. This amount has been applied thus : Reserve fund, £250 ; a dividend at the rate of 3½ per cent. on 5,720 shares, £2,002 ; carried forward, £5. The Board of Trade have rescinded the Kidderminster and Stourport Electric Lighting Order, 1906, in so far as it relates to the town of Stourport, as the company do not see their way, owing to the very small demand in Stourport for electric light and power, to give a supply from the power station at Kidderminster into Stourport. The portion of the order in respect of the Kidderminster foreign area is being developed by the company, and a small revenue is at present derived therefrom.

West African Telegraph Co., Ltd.—In their report for the year ended December, 1911, the directors announce the death of the late Marquess of Tweeddale. John Cuthbert Denison-Pender, Esq., L.C.C., has been elected to the board. The revenue for the period under review amounted to £54,923, from which is deducted £17,083 for the ordinary expenses, and £8,969 for expenditure relating to maintenance of cables and income-tax abroad, leaving £28,872, plus £233 brought forward, making a total available balance of £29,105. £1,377 has been provided for income-tax, £497 has been paid as a bonus to the staff, £17,000 has been transferred to general reserve fund, and an interim dividend of 2 per cent. (free of income-tax), absorbing £4,622, was paid on December 1st last. The directors recommend a final dividend of 2 per cent. (free of income-tax) on and after May 15th, making, with the interim distribution, 4 per cent. for the year, the balance of £987 being carried forward. All payments in respect of the guarantee of the Portuguese Government under its concession, from which this company benefited for 25 years, ceased in September last.

Brisbane Electric Tramways Investment Co., Ltd.

MR. H. R. BEETON, chairman, presided on Monday at Winchester House, E.C., over an extraordinary general meeting of the above company for the purpose of considering, and, if thought fit, approving of a resolution altering the articles of association.

The CHAIRMAN said there was not much to say in elucidation of the resolution, the necessity for which arose in virtue of the policy which had been announced in the report. It was necessary that they should take powers under the articles, which they had not at present, in order to give effect to the dividend policy of issuing a bonus in shares. The books would be closed in Brisbane that day, and it became necessary under the Joint Stock Co.'s Acts to file the contract at Somerset House, in order to constitute the shares fully paid, and for that purpose they had to await the list of shareholders in Brisbane. Therefore, if they carried out their intentions, they would pay the cash dividend on May 21st, and the bonus in shares before the end of June.

MR. J. B. CONCANNON seconded the motion.

Answering a shareholder, the CHAIRMAN said that the money for the shares was required for extensions, some of which were in progress, and had been referred to at previous meetings. They were valuable extensions, from which they hoped to derive considerable benefits. In the event of purchase by the Government, the company would be in no way prejudiced by the issue of shares as a bonus to the shareholders, as by the purchase clause the Government would purchase the undertaking as a going concern at a price based upon the earnings.

The resolution was carried.

Callender's Cable and Construction Co., Ltd.

SIR J. FORTESCUE FLANNERY, Bart., M.P., took the chair at Hamilton House, E.C., on May 2nd, at the sixteenth annual general meeting of the above company.

In moving the adoption of the report (see ELECTRICAL REVIEW, page 684), the CHAIRMAN referred to the absence of Mr. H. Drake (the chairman of the company) through illness, and said that he was glad that on the first occasion of his taking the chair he had so satisfactory a report to put before the shareholders. They would be pleased to know that the accounts had been issued at an earlier date this year, although when accounts were ranged more or less all over the globe it was not easy to get a balance-sheet prepared immediately after the end of the financial year in December. The report was very full, because it was the policy of the directors to take the shareholders as fully into their confidence as they possibly could, especially having regard to the strenuous competition under which the company carried on its operations. They had some difficulties during the year in regard to transport, but they were not affected so much as some manufacturers, because at their Erith works they had a frontage to the River Thames, and they had their own wharf and apparatus, and also control over some tonnage, all of which enabled them to reduce their difficulties to a minimum. Their Colonial trade had been very satisfactory, and they realised the warm feeling that existed amongst their Colonial customers to the manufacturers of the Mother Country. They were doing their very best to foster that feeling, and to combine it with trade advantages such as they knew they could offer to Colonial customers, and of which they seemed willing to take the very fullest advantage. As regarded the United Kingdom, all their old customers—many of them of two generations standing—stuck to them. He was glad to say they had standing connections with many public authorities and large consumers upon which they relied from year to year, and there was no sign of other than a continuance of this good feeling. They were going as far over the world as they could, and it would be observed that they had just taken a large contract in Japan for the city of Tokio. They believed that if, as they intended, that contract was carried out faithfully, it would be the forerunner of other and perhaps still larger business in Japan, because that country had not yet begun to be opened up in the way that it ultimately would be in the comparatively near future as regarded electrical enterprise. They had done a big business with the Post Office in connection with the taking over by the Post Office of the telephone system. They had made special arrangements to carry out this work, and machinery particularly suitable for telephone cables had been concentrated at Erith. Previously they made part of the telephone cables at Erith and part in the works at Lancashire, but now they hoped to be able to give the best possible delivery and to economise in the cost of production. The Anchor Cable Co., of which they were the proprietors, had done extremely well, and they had extended the buildings and added to the plant. Its business had increased, and was increasing, and the policy of the directors some years ago of adding these works to Callender's ordinary business had proved to be more and more satisfactory as time had gone on. Both at the Anchor Works and at Erith the buildings and plant had been kept at the highest possible state of efficiency out of current profits. It would be seen that a new trust company under the care and guidance of Callender's Co. was to be formed. Callender's Co. held certain investments in various power and lighting undertakings which yielded rates of interest quite satisfactory as an ordinary investment, but the holding of these investments did not allow of the money being used in the way they would like in the business, and, therefore, it was proposed to give not only the public, but the shareholders, the opportunity of taking a part in those investments if they desired to do so, and the money so raised would be transferred to the ordinary manufacturing business of that company. The chairman next referred to the appointment of Mr. Allnutt as the secretary of the company, and said that for some years he had been

the office manager of the company, and was thoroughly conversant with all the details of the business. Passing next to the balance-sheet, he pointed out that the board had been entitled to write off £20,000 off machinery renewal. The trade creditors had increased from £107,000 to £152,000, and the bills payable from £80,000 to £107,000, both increases being due to the extended business done. The loan from the bank on account of the St. Helens Co. had been reduced by £10,000, and the loan on account of the Uxbridge Co. had been written out altogether. The profit carried to profit and loss account was £84,781, against £66.320 last year. On the assets side, he pointed out that nothing whatever was put down for goodwill and patents. The gross profits for the year were £129,569, as compared with £98,204 last year, or an increase of £31,364. These good results were due primarily to the splendid business capacity of Mr. T. Callender, the managing director, and the excellent manner in which he had been backed up and supported by the assistant general managers, Mr. J. Callender and Mr. Petersen, and the staff. They had an extremely well-organised staff working in unison, and working almost all over the world, and he believed they could look forward in the future to good results. The opening months of 1911 were promising, and although it was too soon to speak of them with any certain sound, they were very hopeful about the future.

Mr. T. Callender (managing director), in seconding the motion, said he thought the results must be considered satisfactory, for most people had not found the past year a very agreeable one to deal with, for they had an immense amount of trouble in connection with the railway strike and with various items of labour and other unrest. Their company had not escaped free from the imposition of heavy charges, but in spite of this, and in spite of the lessening of the volume of trade during a certain period of the year, they had done very well. In order to arrive at this result they had had to extend their operations on every side. They had a foot in Germany, and from there and from this country they had extended their ramifications to many parts of the Continent. Just now the company had its own men working in Germany, Belgium and Italy, and in a few days they would be starting an important contract in Spain. Considering the difficulties which English firms had in obtaining orders in Continental countries which were hedged round with various troublesome formalities and heavy payments, it spoke well for them that they had been able to carry the flag as they had done into so many and widely scattered parts of Europe. In addition, their work in Australia, South Africa, South America, and last, but not least, India, kept up and extended. In India they had their own office, and practically a completely equipped branch, and they were doing an important business. The contract they had taken in Japan was a large one, but he did not say it was a very profitable one, for the Japanese had an unfortunate knack of leaving little to the manufacturer who supplied them. Still, it was quite satisfactory, under the circumstances, to the company, and they hoped to be able to carry a certain amount of profit from it to the balance-sheet in the current year. At the present moment they were devoting a great deal of attention to China, where they had certain relations. It was possible that the business to be done in China in the materials they supplied would not be important for some years to come, but they recognised that it was no good waiting till the goods of someone else had got a good name in the country, and there they were spending money which would have no immediate result, but which they felt would be very profitable in the end. In regard to the current year's business the first three months had not been unsatisfactory. The volume of trade had been quite good, and they had a considerable number of orders in hand. In fact, their factory was busier than it had been for a considerable number of years at this period of the year. To what extent that good position might continue depended on two important items. The first was the political outlook which seriously affected finance, for financial crises and troubles which arose were apt to cause considerable trouble and reduce the volume of trade. Subject to there being no complications at home or abroad, they hoped that the good outlook at present prevailing would continue. But this also depended on the absence of labour troubles. They happily escaped the worst effects of the coal strike, but coming in touch, as he did, with large employers of labour in the North, he was sorry to say that the unrest in the labour world had by no means disappeared, and there was quite a possibility of still further trouble in the future. So far as their own men were concerned, they had acted very loyally, and no serious questions had arisen between the company and the employés. Unfortunately, however, the views taken by men engaged in daily work were now not quite the same as they were a few years ago, and they were apt to run loose on matters which were of comparatively little importance to themselves, but which were sometimes of the utmost importance to the manufacturer. Their prosperity depended largely on the smooth running of the trade in the country, for if there was trouble in the woollen mills of Yorkshire or in the South Wales coalfields, it was reflected in their business at once. Mr. Callender also referred to the formation of the Trust Co., and concluded by paying a high tribute to the efficiency of the staff.

The report was adopted and the retiring directors were re-elected.

Continental.—Austria.—The A.E.G. Union Electricitäts Gesellschaft, of Vienna, is declaring a dividend of 7 per cent. for the last financial year, the same as for the preceding 12 months.

Hungary.—Messrs. Ganz & Co., of Budapest, report a net profit of £26,586 for the last financial year, as compared with only £23,203 in the preceding 12 months. The dividend is being increased from 6 to 7 per cent.

Electric Supply Corporation, Ltd.

The directors' report for 1911 says that the gross earnings amounted to £29,392, an increase of £3,926 upon the corresponding figures of the previous year. The sum taken into net revenue account amounts to £13,167, as against £11,224 for 1910. After paying interest upon debenture stock and temporary loans, also the actual cost of the year's repairs and renewals, the company has, with the balance brought forward, a surplus of £6,962. Of this, it is proposed to place £800 to the renewals account; to distribute a dividend at the rate of 2 per cent. per annum for the year, less income-tax; and to carry forward £2,207. The following table shows the progress made by the company during the last four years:—

Year.	Equiv. in 32-watt lamps connected.	Units sold.	Gross earnings.	Profit including investments.
1908	97,778	3,034,087	£21,240	£6,566
1909	113,699	2,492,416	23,801	9,300
1910	135,719	2,479,172	25,466	11,224
1911	172,202	3,070,851	29,392	13,167

During 1911 the company received a dividend on their 6 per cent. preference shares in the Dumbarton Burgh and County Tramway Co., Ltd. These shares were disposed of during the year. The Hendon Electric Supply Co., Ltd., has distributed a dividend of 5 per cent. for 1911, and the amount received has been brought into these accounts.

Lamps Connected (Equivalent in 32-Watt Lamps).

	1910.	1911.	Inc.
Chelmsford	30,037	31,684	1,647
Jedburgh	3,445	3,618	173
Melrose	3,876	4,461	585
Dalkeith	6,816	7,169	353
Dollar	2,274	2,419	145
Totnes	4,294	4,695	401
Exmouth	12,279	14,034	1,755
St. Andrews	18,717	21,964	3,247
Hitchin	7,762	8,925	1,163
Dumbarton (A)	34,583	59,576	24,993
Falmouth	11,636	13,657	2,021
	135,719	172,202	36,483
Hendon (B)	40,108	55,967	15,859
Dawlish (C)			

(A) These figures take no account of the supply to the Dumbarton Burgh and County Tramways, which used 581,185 units in 1911. The company holds 29,490 £1 ordinary shares (out of 80,000 issued) in the Dumbarton Burgh and County Tramways Co., Ltd. The traffic receipts of the tramways were £18,877 in 1910, and £19,956 in 1911.

(B) The company holds 3,793 £5 ordinary shares (out of 6,630 issued) in the Hendon Electric Supply Co., Ltd.

(C) The company holds 356 £1 ordinary shares in the Dawlish Electric Light and Power Co., Ltd.

Wolverhampton District Electric Tramways, Ltd.

Mr. S. R. Blundstone presided on May 2nd over the annual meeting of this company held at the offices of the Electrical Federation, Kingsway, London.

In moving the adoption of the report, the Chairman said the receipts of the past year had increased by £1,070, chiefly due to the improvement in trade which had taken place in the district served by the company's tramways. In spite of the fact that 247,000 more passengers were carried than in the previous year, the power and running expenses had only increased by £26, and the administration and general expenses by £17. The repairs and maintenance costs showed a reduction of £276, and £160 had been written off the cost of the Dudley current arbitration out of the profits, as compared with £312 in the previous year; these two items together cleared off the whole cost of the arbitration, so far as that company was concerned. £1,000 was provided for renewals, as in the previous year. The net result of the working was that the company was £1,578 better off than in the previous year, and, including the amount brought forward, there was £2,133 to be dealt with. It was proposed to apply £760 to the sinking fund, £1,000 to depreciation and renewals, and to carry forward the balance to next year's account. The sinking fund would now be £3,856, and the depreciation and reserve fund, £4,587. The arrangement by which the company was managed by the Birmingham and Midland Joint Committee had been continued, as, by this arrangement, greater economy of management was obtained than if it were worked as a separate undertaking. The City of Birmingham Tramway Co. retired from the Joint Committee in March last. The chairman then referred to the rating decision given in the case of the Metropolitan Electric Tramways Co. and the Tottenham U.D.C., as the result of which, he said it was hoped their rates would be considerably reduced in the future.

Mr. Allen seconded the motion, which was carried, and Mr. J. A. Lycett, the retiring director, was re-elected.

Leatherhead and District Electricity Co., Ltd.—The accounts for the year 1911 show that the revenue from Leatherhead was £1,630 and from Ashtead £2,342, total £3,972. After meeting generation, distribution, and management expenses, the Leatherhead balance of profit is £975, and that of Ashstead £1,472, total £2,448. £314 is carried to Leatherhead depreciation account, and £773 to Ashtead depreciation account. The net revenue appropriation account for the year shows thus:—By balance from last account £1,561, less dividend of 3½ per cent. £1,197 = £364, plus balance from net revenue accounts as follows:—Leatherhead £672, Ashtead £711 = £1,383, making £1,748, which is carried to the general balance-sheet.

Bank Rate.—The Bank Rate was yesterday reduced from 3½ to 3 per cent.

River Plate Electricity Co., Ltd.

THE directors report continued steady progress during 1911. The net revenue, after providing for administration expenses, bad debts, and depreciations, was £47,200, plus £5,889 brought forward. Interest on the 5 per cent. debenture stock requires £10,000, leaving a suplus of £43,089. The preference dividend of 6 per cent for the year required £7,500; a dividend of 10 per cent. upon the ordinary stock, £12,000; addition to general reserve, £15,000; further remuneration to directors, £930; and £7,659 is to be carried forward. The total reserves stand at £136,422. In November a provisional agreement was concluded with the Government of the Province of Buenos Ayres for the continuance of the supply of public lighting by this company in the City of La Plata and the town of Ensenada until the year 1927, at least. This agreement has been confirmed, and has now become law. Under this contract the company agrees, as regards a definite area in the city, to place its cables and electrical connections underground, and also within five years to transfer its generating plant from La Plata to the new power station at Ensenada. On the other hand, the contract provides for large additions to the public lighting to be supplied by the company, and paid for by the province, and, in addition, the company's entire exemption from taxation is continued during the currency of the extended public lighting contract. The board regard this new contract as highly advantageous alike to the Government and to the company. Important industrial developments have arisen in the past year, and are now in active progress at Ensenada, which will add greatly to the working population in the immediate future. Increased demands for public and private lighting, and for power for industrial purposes, will follow on this growth of population. With a view to meeting the increased business anticipated, extensive additions to the new generating station at Ensenada are necessary. A contract for a 6,000-KW. turbo-generator, with all necessary boiler and other auxiliary plant, has been placed. It is expected that within two years the company will be in a position to conduct the whole work of generating light and power at Ensenada. Considerable economies in working will result when production is concentrated there, while the entire transfer of the works from La Plata will free for sale in the future a large and important building site of growing value near the centre of the city. The capital expenditure involved in the extensions and improvements will be spread over two years. A considerable part of this expenditure will, in accordance with the policy heretofore pursued, be provided out of current earnings, but as further provision the board have decided to offer for subscription the unissued balance of £30,000 ordinary share capital of the company. These shares, which are of the denomination of £1, will be issued at a premium of £1 per share. The whole premium of £1 per share will be added to the general reserve fund. The third payment on account of the amortisation of the 5 per cent. obligations of the German Transoceanic Electric Co. (Series 1) held by this company—viz., £1,800, was duly made on April 1st, 1911, reducing the amount outstanding to £144,800.

The annual meeting was held on April 30th, at Capel House, New Broad Street, E.C.

MR. M. W. MATTINSON, who presided, said that the net revenue of their three stations in the Argentine had amounted to £48,015, compared with £43,505 a year ago, an improvement of £4,600. In 1910 the company had an exceptional profit of £3,000, due to the great illuminations in La Plata to celebrate the centenary of the Argentine Republic, and the comparison, therefore, was the more favourable, as in the past year they had nothing of the kind. The increase in revenue was almost wholly at La Plata and Ensenada, and was due to no abnormal circumstances, but to the steady growth in the size and importance, and in the industrial activities of those towns. Their receipts from sources other than the profits of the three electrical stations, that was to say, interest upon their large investment in the 5 per cent. obligations of the German Transoceanic Co. and interest upon investments and exchange, came to £9,017, which was 90 per cent. of their annual debenture charge, showed a reduction of £1,274. Last year he told the shareholders of that reduction, and pointed out that in the item of interest for that year they had a whole year's dividend on the shares of the Rosario Electric Co., and that as they had sold those shares at a large profit, and the proceeds had gone in the extensions at Ensenada they could not hope to have the interest as well. The company would, however, get a very full equivalent in the near future for this loss of interest. The extensions at Ensenada would give them a good return upon the money involved, but during the year under review their revenue only benefited to a very moderate extent from that source. The station at Esenada was now finished and running satisfactorily. On the other side of the revenue account the only material increase in the outgoings was for depreciation of fixed plant. The final outcome was that the net balance available for dividend and other purposes was £47,200, against £45,026, an increase of £2,173. They again paid a dividend of 10 per cent. upon the ordinary stock, added £15,000 to reserve, against £14,000, and carried forward £1,771 more than they brought in. There was no doubt those figures would have justified a higher dividend than 10 per cent., but they were deliberately following the policy of restricting the dividends on the ordinary stock and strengthening the capital resources of the company. He was in the Argentine last September and spent a great deal of time in La Plata and Ensenada, going most carefully into the company's interests. That was the third occasion upon which he had visited La Plata, and he observed with much gratification the evidences of progress which were apparent on every side. The two tramway systems to which their company supplied the current under long-term contracts, and in one of which they were considerable shareholders, were extending their systems all over the town and down to Ensenada, and building operations were going on rapidly everywhere, and in particular in La Plata, a much better type of house and shop was being put up. A new Government railway which opened up new country and ended at La Plata and Ensenada, was nearing completion, and since his return he had heard that they had taken over the lighting of the railway station, and it was probable that within a year their company would be supplying light and power to the extensive workshops of the railways being erected in the suburbs. As regarded Ensenada, he told the shareholders a year ago that he thought that they might look for considerable industrial progress there. He confessed he did not think his anticipations would be so quickly realised. Heretofore the docks at Ensenada had been the principal, though not the only source of employment there, but they were overhadowed by the docks at Buenos Ayres, 30 miles distant, and they did nothing like the trade they ought to have done. Things, however, were rapidly changing. In the first place, the docks at Buenos Ayres were quite inadequate to the demands upon them, and there was an overflow to La Plata, and in addition La Plata was getting further railway outlets. At Tucuman they were threatened by further competition by a company called the "Hydro-Electric Co., of Tucuman." That company had in course of construction an installation to utilise water-power at the Lules River and transmit electricity to Tucuman, where it was proposed to supply in direct competition with the Electrica del Norte and their company. The city of Tucuman was already fully supplied with light, power and trams, by two powerful companies who were resolved to maintain their position.

MR. ROBERT MILLER seconded the motion, which was carried.

Rangoon Electric Tramway and Supply Co., Ltd.

THE annual meeting was held on April 30th, at 3 and 4, Great Winchester Street, E.C., Mr. Frank Tobin, who presided, in proposing the adoption of the report (see ELECTRICAL REVIEW, page 687), said that the increase in the capital expenditure last year, which amounted to £45,778, was mainly due to the purchase and erection of the new 2,500 KW. turbine and the extension of mains to the suburbs of Rangoon. The power house, including land, buildings and plant had cost altogether £265,796. The receipts from their tramways showed a slight falling off, which was caused by the pauperism that had prevailed among the poorer classes in Rangoon. When that unhappy condition of things passed away they might confidently look for a considerable improvement in their receipts. In spite of the decrease in the tramways, there had been a considerable improvement in the profits from the light and power branch of the business; the decrease in the former being more than made up by the improvement in the latter. The house-wiring department had also been very satisfactory, the profit having increased from £769 in 1910 to £2,020 last year. He did not anticipate that they would have to spend anything on new machinery for some time to come, although they would doubtless have to continue expenditure on the upkeep of mains, as they were the things that brought in income. In conclusion, the CHAIRMAN paid a tribute to the staff in Rangoon for the excellent manner in which they discharged their duties.

SIR F. W. R. FRYER, K.C.S.I., seconded the motion, and the report was adopted

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Lisbon Electric Tramways, Ltd.—The directors' report for 1911 shows that a net profit of £103,374, plus £6,242 brought forward, making £109,616. From this £35,000 has been placed to depreciation reserve and £5,000 to the credit of exchange reserve account. There remains an available balance of £69,616, out of which the usual preference dividend, amounting to £25,533, has been paid. On November 1st the directors paid on the ordinary share capital an interim dividend of 3 per cent. net, amounting to £19,020, and they now recommend a final dividend at the same rate, making 6 per cent. net for the year; £6,041 has been carried forward. The board has deemed it advisable (says the *Financier*), having regard to the heavy and continued fall in values of investment securities, more especially those of the gilt-edged class, to write down the holdings of the company by £8,457, which has been charged against the depreciation reserve account. The traffic receipts show the satisfactory advance of Rs61,892,612 over the previous year's working, this being largely due to the exceptional advantage of record receipts during the festivities in connection with the anniversary of the Republic. On the other hand, the Lisbon working expenses have increased by the sum of Rs84,375,243, owing to the heavy burden of the higher wage charges imposed under the arbitration award referred to in last year's report. The net result is a somewhat smaller profit than shown for the year 1910. In March a general strike was declared in Lisbon, causing the service to be temporarily curtailed. The employés showed their loyalty, and the only loss suffered by the company was a slight falling-off in the revenue through the partial stoppage of the traffic.

Eastern Telegraph Co., Ltd.—The directors, after making a contribution to the general reserve fund, payment of interest on the 4 per cent. mortgage debenture stock, dividend on the 3½ per cent. preference stock, and three interim dividends of £1 5s. per cent. each on the ordinary stock to September 30th, recommend (says the *Financier*) a final dividend of £1 5s. per cent., and a bonus of £2 per cent., making a total distribution of 7 per cent. on the ordinary stock for the year.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and may vary according to quantities and other circumstances.

Wednesday, May 8th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a ,, Nitric	,,	22/-	..
a ,, Oxalic	per lb.	2¾d.	..
a ,, Sulphuric	per cwt.	5/6	..
a Ammoniac Sal	,,	42/-	..
a Ammonia, Muriate (large crystal)	per ton	£29 10	..
a Bleaching powder	,,	£5 10	..
a Bisulphide of Carbon	,,	£18	..
a Borax	,,	£16 10	..
a Copper Sulphate	,,	£24 15	..
a Lead, Nitrate	,,	£26 10	..
a ,, White Sugar	,,	£25 10	..
a ,, Peroxide	,,	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	3½d.	..
a Potash, Caustic (88/90 %)	per ton	£22 10	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Perchlorate	,,	4½d.	..
a Potassium, Cyanide (98/100 %) (for mining purposes only)	,,	7½d.	..
a Shellac	per cwt.	75/-	..
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers	,,	£6 10	..
a ,, Recovered	,,	£5 10	..
a ,, Lump	,,	£5 5	..
a Soda, Caustic (white 70/72 %)	,,	£10 5	..
a ,, Chlorate	per lb.	3½d.	..
a ,, Crystals	per ton	£3 5	..
a Sodium Bichromate, casks	per lb.	3d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots	per ton	£67	..
b ,, Wire, in ton lots	,,	£102	..
b ,, Sheet, in ton lots	,,	£120	..
p Babbitt's metal ingots	,,	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	8½d.	..
c ,, Tube (brazed)	,,	10½d.	..
c ,, ,, (solid drawn)	,,	9d.	..
c ,, Wire, basis	,,	8¾d.	½d. inc.
c Copper Tubes (brazed)	,,	11¾d.	½d. inc.
c ,, ,, (solid drawn)	,,	10¾d.	½d. inc.
g ,, Bars (best selected)	per ton	£86	..
g ,, Sheet	,,	£86	..
g ,, Rod	,,	£86	..
d ,, (Electrolytic) Bars	,,	£74 10	..
d ,, ,, Sheets	,,	£91 10	..
d ,, ,, Rods	,,	£79 10	..
d ,, ,, H.C. Wire	per lb.	9½d.	..
f Ebonite Rod	,,	5/8	..
f ,, Sheet	,,	4/9	..
n German Silver Wire	,,	1/11	..
h Gutta-percha, fine	,,	..	..
h India-rubber, Para fine	,,	4/7½	1½d. dec.
i Iron Pig (Cleveland warrants)	per ton	58/1½	5½d. dec.
i ,, Wire, galv. No. 8, P.O. qual.	,,	£14	..
g Lead, English Pig	,,	£13 15s. to £16 17s. 6d.	10/- inc.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£8 5	7/6 dec.
e Mica (in original cases) small	per lb.	6d. to 2s.	..
e ,, ,, medium	,,	2/6 to 4/-	..
e ,, ,, large	,,	4/6 to 8/6	..
p Phosphor Bronze, plain castings	,,	11d.	..
p ,, rolled bars & rods	,,	1/0½	..
p ,, rolled strip & sheet	,,	1/1	..
o Platinum	per oz.	185/-	..
d Silicium Bronze Wire	per lb.	10½d.	..
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	,,	£212 to £214	£5 inc.
n ,, Wire, Nos. 2 to 16	per lb.	2/4½	½d. inc.
p White Anti-friction Metals	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	,,	£29 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons
o Johnson, Matthey & Co., Ltd.
p
r W. F. Dennis & Co.

STOCKS AND SHARES.

Tuesday Evening.

SEVERAL of the Stock Exchange markets had rather a shake-out early this week, for which various reasons were advanced, the most likely-looking one being that speculators had bought more than they could carry conveniently, and that as markets sagged a number of the weaker bulls rushed simultaneously to get out. A whole crop of rumours accompany the movements, but none of them carry much weight, although in some quarters a quiet hint that labour trouble may be expected in this country towards the end of the month was associated with the names of prominent members of the Cabinet whose views command respect, even in the Stock Exchange.

In the general set-back amongst Home Railways the Undergrounds suffered with the rest. Central Londons continue to fall, and the Deferred stock is 4 points down, the Ordinary and Preferred showing similar declines. Districts recovered after having given way a little, and Metropolitans are unchanged. The market in Metropolitans, however, is certainly a strong one. We mentioned last week that it might be the Great Western which is angling for control of the company, and now there are suggestions that the Great Central would possibly like to have a hand in the business. City and South London Ordinary rallied ½ after its previous drop of 3 points, but lost the improvement. Great Northern and City Preferred are 5s. lower. East Londons went down as quickly as they rose, and the middle price is once more back to 10, while the Debenture stocks have also experienced a relapse. There is talk of labour trouble at the docks. Underground Electric Railway shares at 4⅛ gave way with other speculative issues, but the 6 per cent. Income Bonds keep firm at 92.

London United Tramways 5 per cent. Preference shares spurted again on top of their big rise, and have reached 5¼ amid growing expectations that the shares may be within sight of an early resumption of dividends. Possibly the present buyers are, perhaps, discounting the future very liberally. British Electric Traction issues are good, the 6 per cent. Preferred being 3 points higher and the 7 per cent. Preferred gaining 3½, these being to some extent in connection with the substantial improvement in London United Tramways. Bath Preference hardened to 15s. on consideration of the good yield obtainable upon the shares at this figure.

The Colonial and Foreign Tramways list is quiet, but there is a good deal of strength about the popular descriptions. Matters in Mexico move very erratically, but the general assumption is that the trouble there will quiet down in time, and meanwhile proprietors of Mexican Light and Traction investments are not selling. Rises have occurred in Mexican Light and Power common shares and First Mortgage Bonds in Mexican Tramways common, and in the company's 6 per cent. bonds; while Mexican Electric Light First Mortgage bonds are ½ higher. Rio Trams continue their remarkable rise, but a good many people elected to take their fine profits round about 130, with the result that the price reacted a trifle from the top. The company is now paying quarterly dividends at the rate of 5 per cent. per annum, and these it is hoped will be raised to at least 7 per cent. before long in consequence of the expansion shown in the receipts. Sao Paulo Trams at 218½ are 4½ better, making a rise of over 10 points within a fortnight; while Montreal Light and Power shares retain their exalted price of 210. British Columbia Electric Railway descriptions have been very steady, and the Indian list is good. Madras Ordinary gained ⅛. Calcutta Ordinary jumped up 12s. 6d., with substantial buying to support the shares. Calcutta Tramways are ⅛ higher at 6⅞. On the other hand, River Plate Ordinary stock slipped back 7 points on the prospect of competition, but the Preference stock rose superior to this consideration, and has a rise of 2 to its credit on the week. Canadian General common shares have gone back 3, although Canadian things, as a whole, have been very much in favour in the markets this week.

The English Electricity list is remarkable only for its steadiness. Bournemouth and Poole Ordinary put on a further 5s. in anticipation of the "something good" to which we alluded last week. Edmundsons' Preference and Westminster Preference are both better. It is worth noticing that two or three issues have been taken out of the Stock Exchange Official List, and therefore removed from our price lists, on account of the fact that no business has been officially recorded in them for several months. The speculation in City of London has quieted down to some extent; but, considering the dulness of some of the other markets in which a large account exists, the firmness of Cities deserves attention.

The Telegraph market continues to be absorbed in the wild movements of Marconis, the prices of which have been jumping up and down like the mercury in a thermometer with which a little hot-handed child is playing. American Marconis dropped to 2¼, rallied to 2⅝, and again receded. Canadians fell back, and Spanish kept them company, while the prices of the new shares and the Preference kept pace with those of the parent company. West India and Panama Telegraph shares dropped abruptly to 3¾ on the announcement of a very disappointing dividend.

National Telephone Deferred is 3½ higher, and the third Preference rose $\frac{1}{16}$, upon the statement of claim made by the National Telephone Company upon the Government in respect of the purchase of its undertaking. The claim, of course, is subject to the arbitration, and were it not so, National Telephone Deferred stock would be standing nearer 200 than 150. The Eastern group is rather duller. Great Northern Telegraphs fell 15s. Anglo-American descriptions are just steady, and there is very little going on in the shares of the manufacturing companies.

Of the Miscellaneous group, Aron Ordinary rose to 16s. 3d., confirming the reference made here last week to the firmness of the market in the shares. British Westinghouse Preference have gone back to 12s. 6d. The quotation of Brush Ordinary has been removed from the lists in consequence of the paucity of business done in the shares, but in substitution we have added the company's 5 per cent. prior lien Debenture stock, the quotation of which is 80 middle. Callender's Ordinary are good at 11⅛, showing a 5s. advance.

Auckland Electric Tramways Co., Ltd. — The directors have declared an interim dividend of 7½d. per share, free of income-tax, on the ordinary shares for the half-year ended December, 1911.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations May 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	10	5½	5½	9¼ — 10¼	+ ¼	5 7 4
Do. 4½ % Pref.	10	4½	4½	8½ — 9½	..	4 14 9
Do. Second 6 % Pref.	10	6	6	10¾ — 11	..	5 9 1
Do. 4½ % Deb. Stock	Stock	4½	4½	100 — 102	..	4 8 3
Brompton & Kensington, Ord.	5	10	10†	8¼ — 8⅝	..	5 14 3
Do. 7 % Cum. Pref.	5	7	7	7⅝ — 8⅛	..	4 6 2
Central Electric Supply, 4 % Guar. Deb.	100	4	4	98 — 101	..	3 19 3
Charing Cross, West End & City	5	5	5	4½ — 5	..	5 0 0
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 4¾	..	4 14 9
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	8¾ — 4¾	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	95 — 98	..	4 1 8
Chelsea, Ord.	5	5	5	4⅜ — 4¾	— ⅛	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	98 — 101	..	4 9 1
City of London, Ord.	10	7	8	20 — 22	..	3 12 9
Do. 6 % Cum. Pref.	10	6	6	16½ — 18½	..	3 4 10
Do. 5 % Deb.	Stock	5	5	119 — 123	..	4 1 4
Do. 4½ % Second Deb.	100	4½	4½	101 — 104	..	4 6 7
County of London, Ord.	10	5	6	10⅜ — 11¼	..	5 6 8
Do. 6 % Pref.	10	6	6	11¼ — 11⅝	..	5 2 7
Do. 4½ % Deb.	Stock	4½	4½	108 — 110	..	4 1 10
Do. 4½ % Second Deb.	Stock	4½	4½	99 — 102 xd	..	4 8 3
Edmundson's, Ord.	5	Nil	Nil	⅛ — ¼	..	Nil
Do. 6 % Cum. Pref.	5	Nil	Nil	3¼ — 3½	+ ⅛	Nil
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 89	..	5 1 2
Folkestone	5	6	6	4⅜ — 4⅝	..	6 3 1
Do. 5 % Cum. Pref.	5	5	5	4½ — 4⅝	..	5 5 3
Do. 4½ % First Deb.	100	4½	4½	93 — 96	..	4 13 9
Hove	5	9	9	6½ — 7	..	6 8 7
Kensington & Knightsbridge, Ord	5	9	9	7¼ — 7⅜	..	5 16 2
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 8
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	80 — 84	..	5 7 2
London Electric, Ord.	3	2	2½	1⅝ — 2	..	3 14 11
Do. 6 % Pref.	5	6	6	4½ — 5½	..	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	92 — 95	..	4 4 3
Metropolitan	5	5	4†	5⅝ — 4¾	..	6 1 3
Do. 4½ % Cum. Pref.	5	4½	4½	4¼ — 4⅜	..	4 17 4
Do. 4½ % First Mort. Deb.	Stock	4½	4½	101 —104	..	4 6 7
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 87	..	4 0 6
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	96 — 98	..	4 11 10
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	3¾ — 4⅛	..	5 14 3
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	97 —100 xd	..	5 0 0
Notting Hill, 6 % Non-Cum. Pref.	10	..	6	10½ — 11½	..	5 6 8
Oxford	5	7½	7½	5⅞ — 6⅛	..	5 13 9
St. James' and Pall Mall, Ord.	5	10	10	8⅜ — 8⅝	..	5 14 3
Do. 7 % Pref.	5	7	7	6⅝ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	85 — 87	..	4 0 6
Smithfield Markets, Ord.	5	Nil	2	1⅜ — 1¾	..	..
South London, Ord.	4	5	5	2⅜ — 3¼	..	6 8 0
Do. 5 % First Mort. Deb.	100	5	5	99 —102	..	4 18 0
South Metropolitan, 7 % Pref.	1	7	7	1⅛ — 1⅛	..	6 1 0
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 0
Urban, Ord.	5	5	..	⅜ — ½	..	..
Do. 5 % Cum. Pref.	5	5	..	2⅜ — 3⅜	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	86 — 88	..	5 2 3
Westminster, Ord.	5	10	10	8½ — 9½	..	5 8 1
Do. 4½ % Cum. Pref.	5	4½	4½	5⅛ — 5⅝	+1/16	4 4 8

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅜ — 5⅞	..	5 2 2
Calcutta, Ord.	5	8½	7†	7⅝ — 8½	+ ⅜	4 6 2
Do. 5 % Pref.	5	5	5	5 — 5½	..	4 15 3
Calgary Power, 1st Mort. Bds.	100	5	5	94½ — 96½	+1	5 2 8
Canadian Gen. El. Com.	$100	7	7†	110 —114	—3	6 2 10
Do. 7 % Pref.	$100	7	7	118 —122	..	5 14 9
Cordoba Lt., Power and T., Ord.	1	3	3†	⅞ — 15/16	..	3 4 0
Do. 5 % Deb.	100	5	..	94 — 97	..	5 3 1
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	83 — 86	..	5 16 3
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	92 — 94	+ ½	5 6 5
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	7/16 — 9/16	..	Nil
Do. 6 % Pref.	1	6	6	31/32 — 1 1/32 xd	..	8 6 0
Kaministiquia Power, 5 % G. Bs.	$500	5	5	103 —105	..	4 15 3
Madras, Ord.	5	..	..	2¼ — 2⅜	+ ⅛	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	102¾ —105¼	..	4 14 9
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	86⅛ — 88½	+2	5 13 0
Mexican Lt. & Power, Common	$100	4	4	86 — 87	+1½	4 12 0
Do. 7 % Cum. Pref.	$100	7	7	104 —106 xd	..	6 12 1
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96 — 98	+1½	5 2 0
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	87½ — 89½	..	5 11 9
Montreal, Lt., H. and Power	$100	7	8	207 —212 xd	..	3 15 6
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	..	39 — 41	..	12 3 10
River Plate, Ord.	Stock	10	..	245 —255	—7	3 18 6
Do. 6 % Non-Cum. Pref.	Do.	6	6	112 —117	+2	5 2 7
Do. 5 % Deb. Stock	Do.	5	5	103 —105	..	4 15 3
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	99 —101	..	4 9 1
Shawinigan Water, Capital	$100	4	5†	137 —141	..	3 10 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	108½ —110½	..	4 10 6
Do. 4½ % Per. Deb.	Stock	4½	4½	104 —106	..	4 4 11
Toronto Power, 4½ % Deb.	Do.	4½	4½	100 —102	..	4 8 3
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	92½ — 94½	..	5 5 10
Victoria Falls Power, Pref.	1	Nil	11¾d.	31/32 — 1 1/32	— 1/32	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	104½ —106½	..	5 12 8

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	Nil	4†	7⅛ — 7⅝	..	..
Do. 5 % Deb. Red.	Stock	5	5	97⅞ — 99⅞	..	5 0 6
American Telep. & Teleg., Cap.	$100	8	8†	148 —150	—1	5 6 8
Do. Collat. Trust	$1000	4	4	95 — 97	+1	4 2 6
Anglo-American Telegraph	Stock	8½	8	65 — 67	..	4 9 7
Do. 6 % Pref.	Do.	6	6	107⅜ —108½	..	5 10 4
Do. Def.	Do.	80/-	80/-	25⅞ — 26½	..	5 14 3
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	101 —102	..	4 17 1
Chili Telephone	5	7	..	7⅞ — 8	+ ¼	4 10 4
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	83⅛ — 85½	..	4 13 7
Cuba Telegraph	10	6	6†	9¾ — 10⅜	..	5 11 7
Do. 10 % Pref.	10	10	10	17 — 18	..	5 11 1
Direct Spanish Telegraph, Ord.	5	4	4†	3⅛ — 3⅜	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	7⅞ — 8¼	..	6 1 3
Do. 4½ % Debs.	50	4½	4½	99 —101	..	4 9 1
Direct United States Cable	10	4½	5	7⅛ — 8 xd	..	6 5 0
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 1
Eastern Telegraph, Ord. Stock	Stock	7	5†	134 —137	..	5 2 2
Do. 3½ % Pref. Stock	Do.	3½	3½	79¼ — 81½	—1½	4 6 0
Do. 4 % Mort. Deb.	Do.	4	4	99¾ —101½ xd	..	3 18 10
Eastern Extension	10	7	5†	12¾ — 13⅛	..	5 5 8
Do. 4 % Deb.	Stock	4	4	99 —101	— ½	3 19 3
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	25	4	4	97 —100 xd	..	4 0 0
Globe Telegraph and Trust	10	5⅞	6†	10½ — 11	..	5 9 1
Do. 6 % Pref.	10	6	6	13 — 13½	..	4 9 0
Great Northern Telegraph	10	18	18	30 — 31	— ⅜	5 16 2
Indo-European Telegraph	25	18	5†	58 — 60	..	5 8 4
Mackay Companies Common	$100	5	5†	84 — 87	+1	5 15 0
Do. 4 % Cum. Pref.	$100	4	4	68 — 71	—2	5 12 8
Marconi's Wireless Telegraph	1	5	..	7⅛ — 7⅜	+ ⅛	..
Do. 7 % Cum. Partic. Pref.	1	16	..	6⅝ — 6⅞	+ ⅛	..
Monte Video Telephone, Ord.	1	6	6	1 — 1⅛ xd	..	5 6 3
Do. 5 % Pref.	1	5	5	⅞ — 1 xd	..	5 10 6
National Telephone, Pref.	Stock	6	6†	99½ —102½	..	5 17 1
Do. Def.	Do.	6	6†	157½ —159½	+3½	3 15 0
Do. 5 % Non-cum. 3rd Pref.	5	5	5	5⅛ — 6 1/16	+ 1/16	4 2 6
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	100 —101 xd	..	4 7 2
Oriental Telep. and Elec.	1	8	8	1⅝ — 1⅞ xd	..	4 11 5
Do. 6 % Cum. Pref.	1	6	6	1⅛ — 1⅜ xd	..	4 16 0
Do. 4 % Red. Deb.	Stock	4	4	89 — 91	+ ½	4 8 0
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	99½ —101½	..	3 18 10
Reuter's	8	5	5†	11 — 11½	..	3 12 6
Submarine Cables Trust	Cert.	6	6	127 —130 xd	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	99 —101	..	4 9 1
United River Plate Telephone	5	8	8	7⅜ — 7⅞	..	5 1
Do. 5 % Cum. Pref.	5	5	5	5⅛ — 5⅝	..	4 8 11
West Coast of America	2½	2½	2½	1⅜ — 1½	..	3 6 8
Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4	4	98 —100	..	4 0 0
West India and Panama Teleg.	10	1½	1½	3⅜ — 3⅞	— 1/16	3 4 6
Do. 6 % Cum. 1st Pref.	10	6	6	10½ — 11	..	5 9 1
Do. 6 % Cum. 2nd Pref.	10	6	6	9¾ — 10¼	..	5 17 1
Do. 5 % Debs.	100	5	5	102⅛ —104½	..	4 15 8
Western Telegraph, Ltd.	10	7	6†	18 — 18½	..	5 3 8
Do. 4 % Deb.	Stock	4	4	99 —101	..	3 19 3
Do. 4½ % Fdg. Bonds	$1000	4½	4½	100 —103	..	4 7 5

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations May 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	7/32 — 11/32	..	Nil
Do. 5 % Pref.	1	5	5	13/16 — 15/16	+1/32	6 8 1
Do. 4½ % Deb.	100	4½	4½	78 — 83	..	5 8 5
Brit. Elec. Trac., 6 % Pref.	100	..	..	12 — 14	..	..
Do. Do. Deferred	100	..	..	7 — 9	— ½	..
Do. Do. 6 % Cum. Pr'f.	100	..	6	92 — 94 xd	+3	6 7 8
Do. 7 % Non-Cum. Pr'f.	100	..	..	42½ — 45½	+3½	..
Do. 5 % Perp. Deb.	100	5	5	93½ — 96½	..	5 3 8
Do. 4½ % 2nd Deb.	100	4½	4½	78 — 82 xd	..	5 9 9
Central London Railway, Ord.	100	3	3	83 — 85	—2	3 10 7
Do. Pref.	100	4	4	86 — 88	—1	4 11 0
Do. Def.	100	2	2	84 — 86	—4	2 6 6
Do. 4 % Deb.	100	4	4	101 —103	..	3 17 8
City & South London, Ord.	100	1½	1½	39 — 40	..	4 1 3
Do. 5 % Pref., 1891	100	5	5	108 —110	..	4 11 0
Do. Do. 1896	100	5	5	103 —105	..	4 15 3
Do. Do. 1901	100	5	5	104 —106	..	4 14 4
Do. Do. 1908	100	5	5	103 —105	..	4 15 3
Do. 4 % Deb.	100	4	4	99 —101 xd	..	3 19 3
Dublin United Trams, 6 % Pref.	10	6	6	10½ — 11½	..	5 2 2
Great Northern & City, Pr'f. Ord	10	Nil	..	1/16 — 2/16	— 1/16	Nil
Hastings Trams, 6 % Pref.	5	Nil	6	1/16 — 3/16 xd	..	8 0 0
Do. 4½ % Deb.	100	4½	4½	71 — 76	..	5 18 5
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	9/16 — 2/16	..	4 6 11
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb.	100	5	5	83 — 85	..	5 17 8
London Elec. Railw'ys, 4 % Deb.	100	4	4	97 — 99	..	4 0 10
London United Trams, 5 % Pref.	10	Nil	..	7/16 — 5/16	+ 1/16	..
Do. 4 % Deb.	100	4	4	79 — 82	..	4 17 7

NAME.	Stock or Share.	Dividends for 1910.	Dividends for 1911.	Closing Quotations May 7th.	Rise + or Fall —	Present Yield p.c. £ s. d.
Metropolitan Railway Consol.	100	1⅛	1⅛	70¾ — 71½	..	2 12 8
Do. Surplus Lands	100	2⅜	2⅜	68 — 70	..	4 3 4
Do. 3½ % Deb.	100	3½	3½	89 — 91	..	3 16 11
Do. 3½ % Pref.	100	3½	3½	86 — 88	..	3 19 7
Do. 3½ % Con. Pref.	100	3½	3½	87 — 89	+2	3 18 8
Metropolitan District Ord.	100	Nil	..	47½ — 47⅞	+ ⅛	Nil
Do. 6 % Deb.	100	6	6	144 —146	..	4 2 2
Do. 4 % Deb.	100	4	4	96 — 98	..	4 1 8
Do. 4 % Prior Lien	100	4	4	98 —100 xd	..	4 0 0
Do. 4½ % First Pref.	100	4½	4½	90 — 92	..	4 17 10
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	5/8	6	1/16 — 1	..	6 0 0
Do. Def.	1	Nil	..	3/32 — 7/32	..	Nil
Do. 5 % Pref.	1	5	5	87/32 — 89/32	..	5 10 6
Do. 4½ % Deb.	100	4½	4½	99 —101	..	4 9 1
Do. 5 % Deb.	100	5	5	97 — 99	..	5 0 0
Potteries, Ord.	1	2	..	3/32 — 7/32	..	..
Do. 5 % Pref.	1	5	5	15/16 — 29/32	..	6 19 3
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
South Metro. Trams, 6 % Pref.	1	6	..	3/4 — 7/8	..	6 17 2
Do. 4 % Deb.	100	4	4	72 — 77	..	5 4 0
Underground Elec. Railways	10	..	..	4 — 4¼	— ¼	Nil
Do. 4½ % Bonds	100	4½	4½	99 —101	..	4 9 1
Do. 6 % Income	100	1	1⅛†	90 — 92	—1	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/16 — 3/16	..	Nil
Do. 6 % Pref.	5	Nil	..	2¾ — 3¼	..	Nil
Do. 4½ % Deb.	100	4½	4½	80 — 84	..	5 7

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref.	5	5	5½	5 3/32 — 5 7/32	..	5 1 2
Do. 2nd Pref.	5	5	5½	4 7/32 — 5 3/32	..	5 7 4
Do. 4 % Deb.	100	4	4	94 — 95½	..	4 3 9
Do. 4½ % Deb.	100	4½	4½	102 —104	..	4 6 7
Do. 5 % Deb.	100	5	5	103 —105	..	4 15 3
Auckland Trams, 5 % Deb.	100	5	5	104 —106	..	4 14 4
Bombay Elec. S. & Trams, Pref.	10	6	6	11 — 11½	..	5 4 4
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % 2nd Deb.	100	5	5	99 —101	..	4 19 0
Brisbane Trams Invs., Ord.	5	8	8	9 3/32 — 9 5/32	..	4 2 1
Do. 5 % Pref.	5	5	5	4 29/32 — 5 1/32	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
B. Columbia Elec. Rly., Def.	100	8	8†	139 —143	..	5 12 0
Do. Pref. Ord.	100	6	6	126 —129	..	4 13 0
Do. 5 % Pref.	100	5	5	111 —114	..	4 7 9
Do. 4½ % 1st Mort. Deb.	40	4½	4½	98½—101½	..	4 8 8
Do. 4½ % Vancouver Deb.	100	4½	4½	103 —105	..	4 5 9
Do. 4½ % Con. Deb.	100	4½	4½	104 —106	+1	4 5 0
Calcutta Trams, Ord.	5	6	7	6 1/16 — 6 3/16 xd	+ 1/8	5 5 8
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Do. 4½ % Deb.	100	4½	4½	100 —103	..	4 7 5
Cape Electric Trams	1	Nil	2½†	2/32 — 3/32	..	..
City Buenos Aires Trams (1904)	5	5	5	5 2/32 — 5 3/32	..	4 5 1
Do. 4 % Deb.	100	5	5	101— 103	..	4 17 3
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	94 — 98 xd	+2	5 2 0
Havana Elec. Rly., 5 % Bonds	$1000	5	5	101 —104	..	4 16 2
Kalgoorlie Elec. Trams	1	Nil	..	3/32 — 5/32	..	Nil
Do. 5 % A Deb.	100	5	5	91 — 94	..	5 6 5
Do. 6 % B Deb.	100	5	6†	56 — 60	..	10 0 0

La Plata Elec. Trms, Ord.	1	..	..	1/16 — 3/32	..	..
Do. Pref.	1	6	6	29/32 — 1	..	6 0 0
Lisbon Elec. Trams, Ord.	1	5½	6†	1 — 1⅛	..	4 8 0
Do. 6 % Pref.	1	6	6	1 — 1⅛	..	4 16 0
Do. 5 % Deb.	100	5	5	95 — 99	..	5 1 0
Madras Elec. Tr. (1904), Deb.	100	5	5	99 —101	..	4 19 0
Manaos Trams & Lt., 1st Deb.	100	5	5	93 — 96	..	5 4 2
Manila Elec. R. and Ltg., Bonds	$1000	5	5	101½—103½	+1	4 16 7
Mexico Trams Com.	$100	7	7	120 —122	..	5 14 9
Do. Gen. Con. 5 % Bonds	..	5	5	96 — 98	..	5 2 0
Do. 6 % Bonds	100	6	6	102 —104	+1	5 15 5
Para Elec. Rlys. & Lt., Ord.	5	10	10	7⅞ — 7⅞	..	6 13 4
Do. 6 % Pref.	5	6	6	5 — 5⅛	..	7 0 4
Do. 5 % 1st Deb.	100	5	5	101 —103	..	4 17 1
Perth (W.A.) Elec. Tr., Ord.	1	2½	..	1 1/16 — 1 3/16	+ 1/16	1 18 4
Do. 5 % 1st. Deb.	100	5	5	101 —104	..	4 16 2
Rangoon El. Tr. & Sup., Pref.	5	6	6	5⅜ — 5⅝	..	5 6 8
Do. 4½ % 1st Deb.	100	4½	4½	99 —101	..	4 9 1
Rio de Janeiro Trams	$100	4½	5†	128½—130½	+1½	3 16 8
Do. 1st Mort. 5 % Bonds	..	5	5	104 —105	..	4 15 3
Do. 5 % Mort. Bonds	100	5	5	97 — 98	..	5 2 0
Sao Paulo Tram, Lt. and P.	$100	10	10†	216 — 221	+3	4 10 6
Do. 5 % 1st Deb.	$500	5	5	104½—106½	..	4 13 11
Singapore Trams, 5 % Deb.	100	5	5	79 — 82	..	5 19 1
Southern El. Tr. B.A., 5 % Deb.	100	5	5	93 — 95	..	5 5 3
Un. Elec. Trams Monte Video	5	6	7	5⅜ — 6	..	6 1 11
Do. 6 % Pref.	5	6	6	5 5/16 — 5 7/16	..	5 12 11
Do. 5 % 1st Deb.	100	5	5	100 —103 xd	+1½	4 17 1
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	102½—104½	— ½	4 6 2

MANUFACTURING COMPANIES.

Aron, Ord.	1	Nil	6	3/32 — 7/32	+ 1/32	6 17 2
Do. 6 % Pref.	1	9	6	29/32 — 31/32	..	7 2 2
Babcock & Wilcox	1	26	28	6 1/32 — 6 3/32	..	5 0 0
Do. Pref.	1	6	6	1 5/32 — 1 7/32	..	3 16 10
B.I. & Helsby Cables	5	10	10	6 29/32 — 7 1/32	..	6 18 0
Do. Pref.	5	6	6	5 29/32 — 6 1/32	..	4 16 0
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
British Thomson-Houston, Deb.	100	4½	4½	91½ — 94½	..	4 15 3
British Westinghouse, Pref.	3	Nil	..	3/32 — 5/32	— 1/32	Nil
Do. Deb.	100	4	4	65 — 66	..	6 1 3
Do. 6 % Prior Lien	100	6	6	99 —102	..	5 17 8
Browett, Lindley, Ord.	1	Nil	..	1/6—2/-	..	Nil
Do. Pref.	1	Nil	..	5/- —6/-	..	Nil
Brush, 7 % Pref.	2	Nil	..	0 — 1/32	..	Nil
Do. 5 % Prior Lien Deb.	100	5	5	77⅛ — 82⅛	..	6 1 3
Do. 4½ % Deb.	100	4½	4½	54 — 59	..	7 10 6
Do. 4½ % Second Deb.	100	4½	4½	37 — 42	..	10 14 4
Callender's Cable	5	15	10†	11½ — 12	+ ½	6 5 0
Do. Pref.	5	5	5	5 — 5⅛	..	4 15 3
Do. Deb.	100	4½	4½	99⅜—101⅜	+ ⅜	4 8 8
Castner-Kellner	1	17½	30	3⅝ — 3⅞	..	5 6 8
Do. Deb.	100	4½	4½	105 —109	..	4 10 7
Crompton & Co.	3	Nil	Nil	1/32 — 3/32	..	Nil
Do. Deb.	100	5	5	58 — 68	..	7 7 1

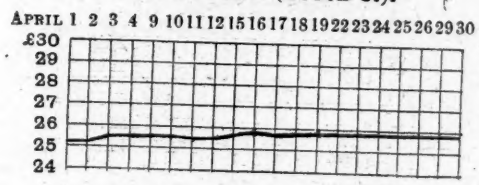
Dick, Kerr	1	5	..	3 7/32 — 3 11/32	..	5 8 1
Do. Pref.	1	6	6	1 29/32 — 1 31/32	..	5 12 11
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Edison & Swan, A, £3 paid	5	Nil	..	1/32 — 3/32	..	Nil
Do. fully paid	5	Nil	..	1 7/32 — 2 3/32	..	Nil
Do. 4 % Deb.	100	4	4	68 — 72	..	5 11 1
Do. 5 % Second Deb.	100	5	5	75 — 78	..	6 8 2
Electric Construction	2	Nil	2½†	1 29/32 — 1 31/32	..	..
Do. Pref.	2	7	7	1 29/32 — 1 31/32	..	7 9 4
Greenwood & Batley, Pref.	10	7	7	7 — 8½	..	8 5 8
Do. Deb.	100	5	5	94 — 96	..	5 4 2
General Electric, Pref.	10	5	5	9 — 9½	..	5 5 3
Do. Deb.	100	4	4	85 — 90	..	4 8 11
Henley's, Ord.	5	15	10†	11½ — 12½	..	6 0 0
Do. Pref.	5	4½	4½	4 13/16 — 5 1/16	..	4 6 9
Do. Deb.	100	4½	4½	104 —106	..	4 4 11
India-Rubber, G. & T.	10	10	5	8⅜ — 9½	..	..
Do. Pref.	10	5	5	9¼ — 10⅛	..	4 17 7
Telegraph Construction	12	20	10†	34 — 36	..	6 13 4
Do. Deb.	100	4	4	99⅜—101⅜	..	4 9 0
Willans & Robinson	1	Nil	..	3/32 — 5/32	..	Nil
Do. Pref.	5	Nil	..	1/16 — 1/8	— 1/32	Nil
Do. Deb.	100	4	4	59 — 61	..	6 11 2

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

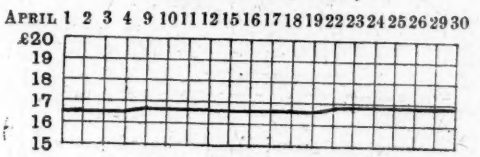
METAL MARKET.

Fluctuations in April.

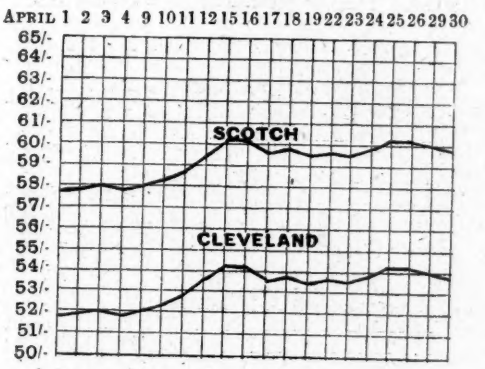
SPELTER (G.O.B's.).



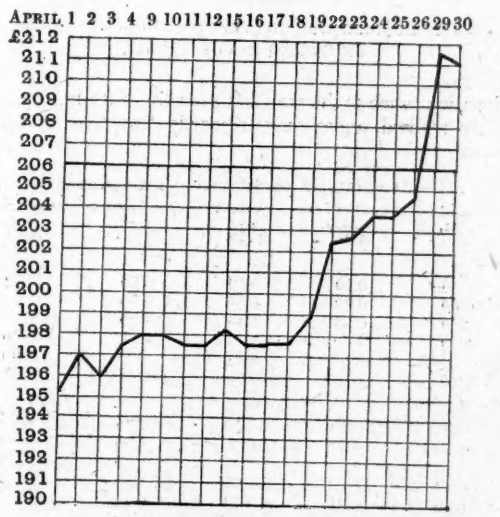
LEAD (ENGLISH).



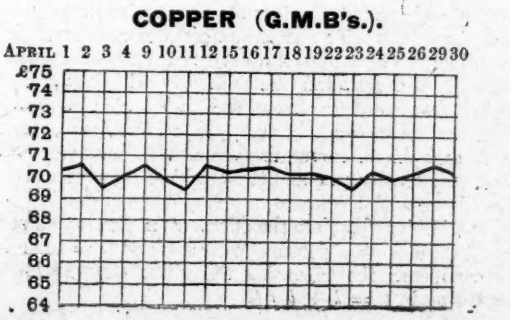
IRON.



TIN.



COPPER (G.M.B's.).



THE CHARACTERISTICS OF COPPER AND ALUMINIUM OVERHEAD LINE CONDUCTORS.

By E. V. PANNELL.

The assertion has been made that in the sequence of processes involved in the production, distribution and utilisation of electric power the weakest link is in the transmission line; the same being far more liable to electrical or mechanical failure than any of the generating, transforming, or converting apparatus. Whether this statement be justifiable or no, it is certain that until recently considerably less attention and care have been devoted to the line than to the electro-dynamical plant, and only of late has the former received its due share of attention. In this country, of course, long-distance overhead transmission is only in its embryonic stage, and little in the way of operating data is available. When, however, the time is ripe, we shall undoubtedly profit by the experiences of transmission engineers in Europe and America who have accomplished the pioneer work in this field. Such engineers have by no means neglected to study the relative utility of various conducting materials, and it is far from being the claim of the author to have opened up a new subject. The object of this article is, however, to set forth a few rules by the use of which a comparison of line conductors may be readily made, and to attempt a few deductions from the same as far as apply to our British conditions.

In the field at the present day there may be said to be two active competitors as conducting materials, viz., copper and aluminium. In preference to the latter metal in its pure state, alloys have often been experimented with. Bearing in mind that the tensile strength of aluminium may be increased upwards of 60 per cent. by judicious alloying without a very great decrease in conductivity, this would seem to be justified. It is, however, found in practice that no such alloy is as resistant to corrosive effects as pure aluminium, and this disadvantage is sufficient to discount the use of alloys for bare overhead conductors. For abnormally long spans, stranded cables of steel have frequently been used both in Europe and America, but the drawbacks to their general use are quite apparent. To take advantage of the high tensile strength by spacing the supporting structures farther apart would result in so great an expenditure on the latter as entirely to off-set any saving on the conductors.

The comparative physical properties of copper and aluminium have been detailed at length on several occasions, and need not be dwelt on here. Such properties as are relevant to this investigation are set out in Table I below. It should be noted that the

TABLE I.—Properties of Copper and Aluminium Stranded Overhead Conductors.

	Copper.	*Aluminium.*
Relative conductivity %	100	60
Specific gravity	8·95	2·71
Relative weights for equal conductance	100	50
Relative cross-section...	100	166
Tensile strength, lb. per sq. in. ...	60,000	30,000
Factor of safety	5	5
Maximum working stress	12,000	6,000
Modulus of elasticity	12,000,000	9,000,000
Specific extension λ	·00000008	·00000011
Coefficient of expansion α	·0000093	·0000130
$\beta = \alpha/\lambda$	116	118
Extension in ft. for full working stress, 100 ft. span	·096	·066
Do. 200-ft. span	·192	·132
Do. 400-ft. span	·384	·264

physical constants are such as apply to stranded cables in both cases, as all schemes transmitting appreciable quantities of energy now use stranded conductors. This is more than usually true in this country, where it is doubtful if legislation will permit of the use of such high line voltages as render the use of a small solid conductor preferable to the equivalent stranded cable. Before leaving the question of fundamental properties, it should be mentioned that now

that such large quantities of high-grade aluminium are being produced for electrical work, the conductivity and tensile strength can be confidently guaranteed. Conductivity and freedom from corrosion are equally dependent on the purity of the metal, and improvements in production have rendered it possible to place upon the market aluminium of well over 99 per cent. purity.

The enormous outlay called for by the line conductors of a transmission scheme renders the economic question a vital one, and before a comparison such as this is justifiable the competing metal must show an advantage over copper in respect of capital invested. In this connection the diagram shown in fig. 1 gives a graphical means of estimating the

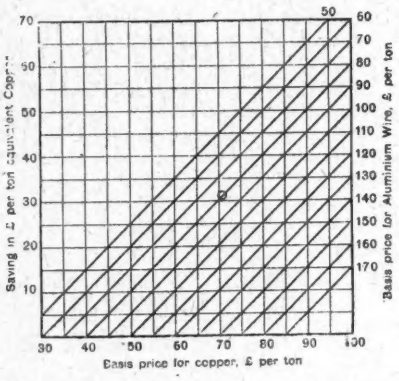


Fig. 1.—Diagram for Estimating the Saving effected by the use of Aluminium.

difference of cost between the two metals, yielding the result in terms of pounds sterling by which aluminium is cheaper than copper per ton of the latter. The prices considered are the basis ones for wire in each case. A small circle has been inscribed to represent the approximate prices ruling at the time of preparation of this article (January, 1912), the figures being :—

Copper (per ton)	...	...	...	£71	0 0
Aluminium (half-ton)...	...	...		40	0 0
Saving in favour of aluminium	...			£31	0 0

This computation, of course, takes into account the fact of aluminium being for a given conductance exactly half the weight of copper. The extra charges for drawing and stranding are a function of the length of the cable, hence on a mileage basis are approximately equal for both metals. The saving as calculated on the above basis is therefore unaffected except where multi-stranded cables of small diameter wire are employed.

Turning to the technical problems involved, a starting point is fixed by the Board of Trade recommendations for overhead line construction. Briefly stated, these call for a stress in the conductor not exceeding one-fifth of the ultimate tensile, assuming a temperature of 22° F. and a horizontal wind pressure of 30 lb. per sq. ft. (corresponding to 18 lb. per sq. ft. on the projected surface of the wire). These values together with certain of the physical constants already set forth can by suitable manipulation be substituted in the standard equation for deflection and stress, where—

$$\text{Deflection at mid-span } \delta = w\, l^2/8\, a\, s,$$

and in which w = loading per foot run, lb. ; l = span in feet ; a = cross-section of conductor, sq. in. ; s = maximum working stress, lb. per sq. in. The deduction of this equation from the catenary need not be entered into here.

The loading on the wire (w) is the resultant of its weight w and the wind pressure p—

$$w = \sqrt{w^2 + p^2}—$$

and the inclination of the plane in which the conductor will hang is given by—

$$\text{Angle with vertical } \theta = \tan^{-1} p/w,$$

the two forces p and w acting at right angles. In estimating these and other functions it has been found convenient to use as a basis the outside diameter of the cable. A relation between this quantity and the sectional area has been plotted in fig. 2, and the approximation is very close indeed.

The loading (w) is shown by the curves in fig. 3, which are plotted from the figures set out in Table II, and in which

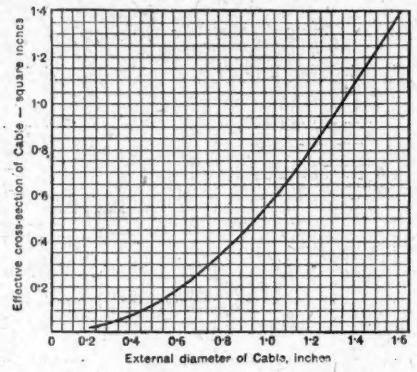


Fig. 2.—Diameter of Stranded Conductors.

both of the components and the resultant have been plotted as a function of the cable diameter. The enormous preponderance of wind over weight loading in the smaller sizes will be noted. This, however, only represents abnormal conditions, inasmuch as the specified pressure of 30 lb. per sq. ft. is only realised under extraordinarily tempestuous circumstances.

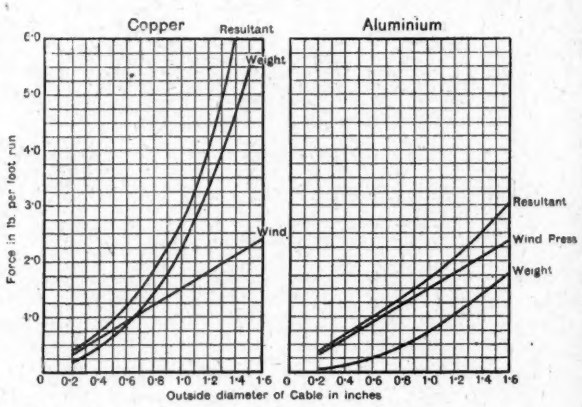


Fig. 3.—Loading due to Weight and Wind-Pressure on Overhead Conductors.

Table II.—Particulars of Stranded Overhead Conductors.

Dia. of cable, in.	Effective cross-section, sq. in.	Weight per ft., lb.	Wind pressure per ft., lb.	Resultant force per ft., lb.
		Copper.		
0·40	0·10	0·40	0·60	0·72
0·60	0·22	0·81	0·90	1·21
0·80	0·38	1·43	1·20	1·80
1·00	0·60	2·24	1·50	2·70
1·20	0·84	3·34	1·80	3·90
1·40	1·15	4·65	2·10	6·00
		Aluminium.		
0·40	0·10	0·12	0·60	0·62
0·60	0·22	0·26	0·90	1·00
0·80	0·38	0·44	1·20	1·30
1·00	0·60	0·69	1·50	1·65
1·20	0·84	1·01	1·80	2·05
1·40	1·15	1·40	2·10	2·50

As already stated, the formula above given represents the conditions obtaining at minimum temperature, 22° F. With increase of temperature the factor of linear expansion will come into play and the deflection will increase. It is highly important to know the value of the maximum deflection under conditions of high summer temperature, in order that the minimum distance of the line above ground-level may be observed and the height of the poles chosen in accordance with the same.

Considering therefore the effect of a rise in temperature = $t°$ F., if α = expansion coefficient and L = total length of conductor, the expansion for a rise of $t° = l\,\alpha\,t$, and total length, $L = l + l\,\alpha\,t$.

Now, from the properties of the catenary—

$$L = l + 8\,\delta^2/3\,l \text{ and } L_1 = l + 8\,\delta_1^2/3\,l$$

$$(L_1 - L) = 8\,(\delta_1^2 - \delta^2)/3\,l,$$

but $L_1 - L$ = extension for temperature rise $t^\circ = l\,a\,t$, hence—

$$l\,a\,t = 8\,(\delta_1^2 - \delta^2)/3\,l \text{ and } t = 8\,(\delta_1^2 - \delta^2)/3\,l^2\,a.$$

It has been thought desirable to manipulate the temperature—deflection equation in the above form in order that a correction for the elastic stretch of the wire may be more readily made. It will readily be seen that as the cable expands with increased temperature the stress is relieved. This reduction of stress, however, gives a diminution of strain, and the conductor will, therefore, extend, due to temperature rise, by an amount which is *less* than that calculated by the shortening due to reduction of stress. From the other standpoint it will be seen that the temperature rise for a given deflection will be *greater* than that worked out from the above formula. The correction may, therefore, most conveniently take the form of an increment to the calculated temperature rise. The correction used is a modification of that suggested by Mr. Shields in the discussion on a paper by Burne on "Overhead Constructions" (*Journal* I.E.E., Vol. XXXI., p. 432), which was read before this Institution some ten years ago.

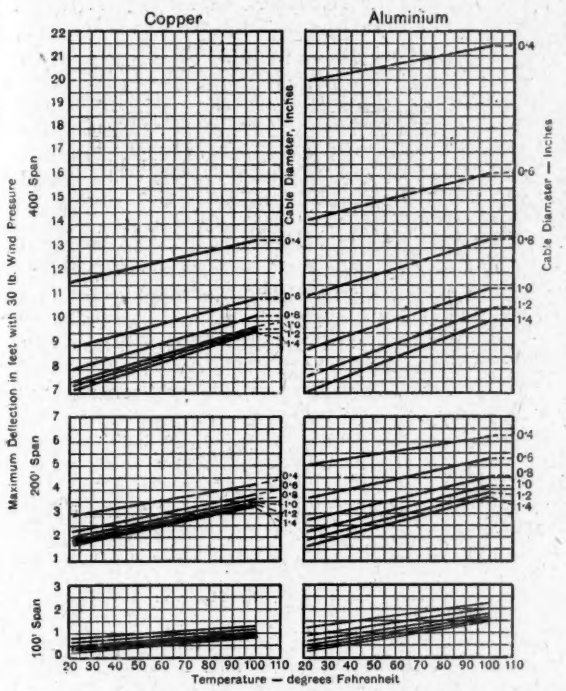


FIG. 4.—DEFLECTIONS ON OVERHEAD CONDUCTORS UNDER VARYING CONDITIONS OF TEMPERATURE.

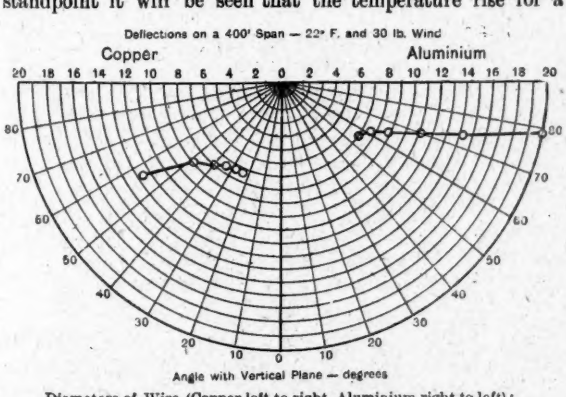

Deflections on a 400' Span — 22° F. and 30 lb. Wind
Copper
Aluminium
Angle with Vertical Plane — degrees
Diameters of Wire (Copper left to right, Aluminium right to left):
0·4, 0·6, 0·8, 1·0, 1·2, 1·4 inches.

FIG. 5.—POLAR DIAGRAM SHOWING THE ANGLE BY WHICH CONDUCTORS ARE BLOWN OUT OF THE VERTICAL.

This correction may be made as follows:—a = per cent. extension per ° F. λ = per cent. extension per lb. per sq. in. stress. $\beta = a/\lambda$.

Now for a change in deflection $= \delta_1 - \delta$, there is a change in stress $= s_1 - s$, and $s_1 = s\,\delta/\delta_1$; hence the increment for correcting the above temperature $= (s_1 - s)/\beta$, and this should be added to the right-hand side of the equation.

On this basis the curves in fig. 4 have been plotted and the results tabulated. It will be noted that maximum wind pressure is assumed throughout, hence the deflection is not only considerably above the normal value, but the conductor will be swung out of the perpendicular by a considerable angle. As already shown the value of this angle is $\tan^{-1} p/w$. It is, therefore, unaffected by temperature, and only depends upon the wind pressure and the weight of the wire. Fig. 5 shows this feature graphically, the values of deflection for a 400-ft. span, at 22° F. and the maximum wind pressure, being plotted in polars.

From the curves in figs. 4 and 5 will be seen, as might be expected, the relatively greater deflections on aluminium conductors, and the greater effect of a given wind pressure. It should be noted, however, that this is largely due to the abnormal value assumed for the latter quantity. Moreover, as will be seen later, a deflection double that of a copper conductor need only call for a pole 10 per cent. higher. The fact that the greater factor in the loading on aluminium cables is this assumed wind pressure, is an advantage on the side of conductors of this material. Under normal circumstances, with moderate winds, the weight of the cable is the more potent factor of the loading, and this value being 50 per cent. lower for the aluminium cables, it follows that the *average* stress in such will be lower in value. This is by no means an unimportant point, as the lower the average stress on any section, the less is the liability to fatigue.

(*To be concluded.*)

EXHIBITIONS AND LECTURES.

[COMMUNICATED.]

THE organisation of a local Exhibition is a task of no small magnitude, as all who have been responsible for one will admit. At the outset, one must be prepared to face almost every kind of difficulty, and to do a vast deal of thankless work. Things have a knack of going wrong at the last moment, and the organiser is so dependent upon others that his individual efforts do not count for as much as he could wish. The secret of a successful Exhibition is system. If it be well thought out beforehand down to the smallest details, and if the correspondence and records generally be properly conducted, much labour will be saved and trouble avoided; on the other hand, if the arrangements be made without the necessary amount of foresight and care, the task will undoubtedly prove an arduous one.

Of the value of an Exhibition, there can in most cases be no two opinions. It is conceivable that districts will vary in this respect, but, generally speaking, a really good and well-advertised show will draw a public of the right class, even when the supply has come to be looked upon as a matter of course, and is no longer a novelty. In small provincial towns Exhibitions are always popular, and the bulk of the residents may be counted on to attend; in larger towns the case is different, and one must be contented with a smaller proportion.

Assuming that conditions seem favourable for holding an Exhibition, and that it has been decided upon, the first step is to choose the right time of the year. In most instances this will be in the late autumn or early winter, as that is the time people begin to have the necessity for lighting and heating forced upon them. Local conditions, however, may materially alter this date, as, for instance, in the case of a pleasure resort, where the winter is a stagnant time and summer is the busy season. After having sounded local and other contractors, the next step will be to secure the hall in which the Exhibition is to be held, taking into full consideration such important details as position, size, and general suitability, and also in some cases, the capability of the distributing mains to carry the temporary excessive load.

As a rule, the Town Hall, Public Swimming Baths, and a Drill Hall are available, and the choice must fall upon the position which best meets the all-round requirements of publicity, convenience, and reasonable cost. An agreement will in all probability be asked for incorporating a clause to the effect that all damage to the premises will be made good by the hirer, and as this may easily run into a considerable sum, the exhibitors must be carefully watched when erecting their stalls.

The length of time the Exhibition shall last is an important point which must be given much consideration. Roughly, it should vary with the size of the town, from, say, three or four days in the provinces, to a fortnight in London or the larger cities. Interest will not be held for a greater period than a fortnight, and in a small provincial town a week is the most that can be counted on. The hours of opening should not be longer than from 11 a.m. to 10 p.m. excepting perhaps on the last night (preferably a Saturday) when closing might be postponed to 11 o'clock. Such preliminary details having been settled provisionally, the next step should be the preparation of a ground plan of the hall, fully dimensioned to scale, or better still, on squared paper, roughly setting out the proposed arrangement of stalls, &c. This will enable the exhibitors to choose their positions, the indication of which on the plan will obviate the possibility of any dispute later. It should not be forgotten that owing to the numerous calls made upon them to assist electricity supply exhibitions by the loan of apparatus, the majority of manufacturing firms have jointly agreed to refuse such applications, and will not now exhibit directly. This is, in a way, more satisfactory for the organisers, as it reduces the number of exhibitors with whom he has to deal and relieves him of some responsibility. The most effective and simplest means of getting in touch with firms willing to exhibit is an advertisement in the electrical papers, setting forth the date of the opening and closing, and the chief conditions with which exhibitors will be asked to comply. This brings us to a rather important question upon which there may be some divergence of opinion. Although not the rule, it seems only fair that each exhibitor should bear part of the cost and pay rental for the space he occupies. It is best to supply current free up to a certain definite maximum demand in KW. to be agreed upon in each case, but all other costs such as carriage, stall hire, and erection and attendance, should be defrayed by the exhibitor. It is as well, in each instance, to set this forth in the form of an agreement or stamped letter, making particular mention of the carriage item which is one that usually gives the most trouble. Responsibility for packing cases, damage to hall, and similar details, should be clearly defined, and the arrangements should of course be rigidly adhered to.

It is when the goods begin to arrive that the necessity for a thorough system becomes apparent. It must be one man's work to take charge of their reception and dispatch, carefully checking all arrivals with the advice notes, and signing for nothing unless he is certain it is undamaged. Further, he should see that all the cases are safely disposed of for the time being, and should ascertain that they bear the owner's name. It will also be his duty to superintend the packing and return of goods where necessary.

During the fitting up of the Exhibition it is most desirable that a representative of the organisers should be present the whole time to prevent damage being done to the building and generally to see that the work is carried out properly with all due precautions against fire or other mishap. Failure of any sort should be most carefully guarded against, and to this end it is necessary to check the operations of the temporary men so often employed on exhibitions.

The question of charging for entrance is a moot one, and it is impossible to recommend any definite course without studying the peculiar conditions of the district. In the writer's opinion, it is best in most cases to impose a small entry fee of, say, 6d., with the object of keeping out the undesirable section of the populace, such as roughs and children; but an equally good scheme, excepting for the loss of revenue, is to allow free admission on presentation of visiting cards. Neither system can be rigidly adhered to, and the door-keeper must be given discretionary powers in this respect. All actual consumers should be forwarded a free pass, and there should be a certain number of season tickets for use in special cases.

Needless to say, the Exhibition must be well advertised, and so far as existing and prospective consumers are concerned there is no better way than to send a ticket and some particulars. To reach the general public, posters should be employed in conjunction with hand-bills and a good displayed advertisement in the local press. The hand-bills may be circulated cheaply and effectively through the medium of friendly tradespeople, who will often agree to place them on their counters; and the presentation of a free pass will generally induce the smaller shopkeepers to display a poster. Advertising should not be attempted earlier than a fortnight before the opening, as otherwise it is apt to get stale and become forgotten. Posters, too, will deteriorate and lose all their attractiveness by the time they are most needed if hung too soon.

The opening of the Exhibition should be performed by some person of good local social standing, such as the member, the Mayor, Mayoress or chief property owner. The Press should be provided beforehand with an article describing the exhibits and making mention of such points as the management wish brought into special prominence. This course is particularly desirable as the lay reporter is apt to get inextricably muddled with technicalities and may unintentionally do more harm than good. He will appreciate the courtesy equally with the lunch or light refreshment that should be provided for him.

If it be decided to issue a catalogue of the exhibits—and something in this line is generally desirable—the firms who are showing should be approached at an early date to furnish the matter and blocks for their space, a restriction being placed on the number of words. When this has all been collected and the best has been done for such firms as may have neglected to send full particulars, it should be made up in dummy form, including advertisements and any local matter deemed necessary. In pursuance of a policy which does not impose annoying extras on the exhibitors they should be allowed a certain amount of space free for advertisement, this item having been taken into consideration when arriving at the amount that shall be charged for floor space. The catalogues will generally sell at a penny, but if the finances appear flourishing they should be given away as they are by no means bad advertisements.

On the subject of the exhibits there is little to be said since it goes without saying that they should be as inclusive as possible. The matter not being entirely in the hands of the organisers it becomes necessary, within limits, to take whatever is offered and be duly thankful. There are, however, one or two special features that may be mentioned, including the office or stall of the supply management. It is not necessary to exhibit anything, as we can assume that the whole field is covered by the contractors; the function of the office is rather that of an inquiry department where information of any sort is available and can be dispensed to the accompaniment of a cigar, or in the case of ladies a cup of tea. It should be enclosed from the public view, tastefully fitted with hired or loaned furniture, and provided with a stock of the department's pamphlets, and price lists of every description. More business is done by such means than by any amount of talk in a crowded hall, and the slight extra expense should on no account be allowed to stand in the way. Diagrams should be prepared and hung on the walls showing, where possible, the increase in lamps connected, and illustrating such points as the comparative floor space taken up by motors and gas engines, and the amount of air vitiation by various illuminants. They will come in afterwards for the office or showroom, and are always useful.

A most effective way of demonstrating the value and convenience of electric light and heat is to fit up one or two model rooms, equipping them with up-to-date electrical apparatus in working order. An upholsterer will generally be found to lend the furniture, and the electrical exhibits can be obtained from the local contractors. Even a small hall will contain a couple of such rooms, which can be built at little cost with matchboarding covered with a cheap plain paper. What are generally termed side shows, and exhibits of a nature foreign to that of the exhibition, should, if possible, be dispensed with. The writer has seen gas

exhibitions where, to make both ends meet, all sorts of miscellaneous trades have been admitted, together with "flying ladies" and other denizens of the penny gaff. Proprietors of such shows will often pay handsomely for space, and hence the temptation is great, but the effect is bad in the extreme since the better class, whom it is chiefly desired to reach, are deterred from patronising the exhibition. If the noise of running machinery is not too great, a band performing at stated intervals will give an additional popularity, and failing this an electrical piano is a good substitute. Only in the largest undertakings would it be possible to include a restaurant of larger proportions than the usual tea stall, but in any case some such arrangement should be made, as it affords an excellent opportunity of demonstrating electrical cooking in actual practice. Plenty of caterers will be found willing to undertake the supply and management of the stall or restaurant, but in most cases it will be necessary to allot them space free as the business done is not great.

Before leaving the subject of Exhibitions, it may be helpful to tabulate the chief items of expenses and receipts. For anything but abnormal conditions, the following will be found practically to cover the ground on both sides :—

Expenses.	Receipts.
Current at cost.	Rent of space.
Rent of hall.	Sale of admission tickets.
Insurance of exhibits.	Sale of catalogues.
Advertising.	
Catalogues and tickets.	
Office of management.	
Orchestra.	
Cost of main in hall, and possibly new service.	
Extra wages.	
Small sundries.	

Necessarily many of these items are difficult to arrive at, and in estimating the results beforehand a good sum should be allowed for contingencies.

Upon the subject of lectures little can be said beyond the general statement that although direct results cannot usually be traced to them, there is no doubt that in some instances they have proved of value. Assuming good organisation, success will entirely depend upon the locality. In some districts lectures dealing with modern applications of electricity illustrated by experiments and working apparatus have done much to help development; in others they have proved more or less fruitless, attracting little or no attention. Before inaugurating any such scheme it is necessary to consider very carefully the temperament of the local population, always bearing in mind that electric cooking, for instance, at present necessitates expensive apparatus, and, therefore, need not be preached to a working class audience. The value of lectures probably lies more in the interest they stimulate in electrical matters generally than in the publicity they give to any particular piece of apparatus. Perhaps the best manner of feeling the local pulse is to offer the services of a lecturer to some society which makes a feature of inaugurating series of educational lectures. If interest be awakened a special series might be started, tickets being sent to every consumer, actual and potential. The experiment is worth making, as the cost may easily be kept within reasonable bounds; if a good audience of the right class can be secured, there is no doubt that lectures will materially help in the task of educating the consumer.

Lectures to employés are a prominent feature in the organisation of several American electricity supply companies. In London, the Gas Light and Coke Co. have for some time past taken full advantage of this indirect means of expanding and improving their business, but little, if anything, has been done by electricity supply concerns, although there can be no question as to the value of a staff whose lay members, to say nothing of the engineering side, are equipped with sufficient technical knowledge to enable them to understand the why and wherefore of every detail of their work. This question is, perhaps, more one of general policy than publicity, but, at the same time it has an important bearing on the latter in an indirect way.

Having no example in this country beyond the enterprising Gas Light and Coke Co., it is necessary again to turn to America, where several instances may be found. The New York Edison Co. have taken up the matter very thoroughly, and in their office building have provided a large lecture hall, which is used chiefly for this purpose. Direct and alternating current, and also a gas supply, are laid on to the lecture table, and the experimental equipment includes arc and incandescent lamps of all types, motors, and heating and cooking apparatus. In addition, there are the necessary measuring instruments, the readings of which are thrown on a screen by the aid of an electric lantern. The lectures extend over the whole field of electricity supply, including the necessary amount of theory. They are delivered twice on the same day, at 1.30 p.m. and 8 p.m., with the object of allowing all members of the staff to attend, and as proof that they are appreciated it is only needful to say that the first 12 lectures delivered were attended by a total of about 4,000 men. This company also provides a technical library for the use of its employés. The educational scheme has so far proved a great success, and besides awakening interest in the work has stimulated industry in many directions.

PROCEEDINGS OF INSTITUTIONS.

High-Tension Porcelain Line Insulators.

By J. Lustgarten, M.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers *at Manchester, March 12th*, 1912.)

Electrical porcelain is eminently suitable for permanent exposed insulation, for which it best fulfils the necessary requirements.

In England the body is made up of kaolin, plastic or ball clay, flint, Cornish stone, and felspar. On the Continent the mixtures generally contain only kaolin, felspar, and quartz, and the resulting porcelain is whiter, while the electric strength is probably greater.

Before glazing, the English vitrified insulator, though hard and of good electric strength, has a surface which attracts moisture, though without sensibly absorbing it; this surface would gather dirt and soot, and, owing to the superficial irregularities, would be very difficult to clean. For this reason, and no other, a coating of smooth and durable glaze is used. The ingredients of this glaze are kaolin, borax, felspar, whiting, and lead monoxide. The glaze may contain different metallic oxides to give either a yellow, brown, green, blue, or black colour. These oxides are non-conducting, and therefore do not affect the insulating properties of the porcelain.

In German practice the unvitrified porcelain is dipped into glaze, which consists only of felspathic materials and quartz, and is subjected to a second firing, which vitrifies the body and matures the glaze at one operation. Of the coloured glazes, brown and green are the only ones that can be successfully produced under these manufacturing conditions.

The American method is very similar to the German. The conventional design of American insulators is by nesting thinner and more shells together than in the European design.

The density of porcelain is about 2·3 to 2·4; English electric porcelains will not absorb water, whether glazed or unglazed. To detect absorption dip a broken piece of the insulator into water coloured with anilin or fuchsin. No coloration should be maintained at the break. Bad porcelain can be detected by its adhering to the tongue.

The linear expansion coefficient of hard porcelain is between 0·0000045 and 0·0000065 (C.), being less than that of glass. This is a recommendation as the porcelain will withstand changes of temperature better. The more felspar in it the greater the linear coefficient; flint has the opposite effect. The relative heat conductivity to that of silver (taken as 100 per cent.) is 0·045 per cent. Its specific heat is 0·17.

The surface leakage is more important than leakage through the material, and has nothing to do with the material itself, but depends upon the humidity of the air and other circumstances affecting the surface. With clean glazed porcelain at normal temperature and humidity the specific resistance on a test-piece amounted to 2×10^{12} megohms. The dielectric constant obtained with direct current is about 5·3. With alternating current the value for a frequency of 50 is about 10 per cent. less, diminishing a further 3 per cent. for a frequency of 100.

The requirement for a high electric strength is a thoroughly homogeneous and vitrified mass, which, however, is difficult to attain with increasing thickness. The puncture voltage of porcelain plates tested between a sphere and a plate is 30 kilovolts for 0·1 in., 55 for 0·2 in., and 94 for 0·4 in. (R.M.S. values).

The mechanical strength of porcelain in compression is about 30 tons per sq. in. The exact tensile strength is difficult to obtain; the mean is about 10 tons per sq. in. The shearing stress of good cement is about 1,600 lb. per sq. in.

The long spans which have come into use subject the insulator to very great stresses, especially at corners and dead-ends. In the pin type the pin is threaded up into the head of the insulator, so that the porcelain is only in compression but not in shear. The insulator can be designed to withstand such heavy testing loads as 3 to 4 tons, the pin bending before fracture of the porcelain commences The suspension cemented type can be designed to withstand a con

tinued shear and tension up to 5 tons. In practice, conditions are arranged so that the wire will break or the pin will bend before the porcelain gives way.

In high-tension insulators the surface resistance is of subsidiary importance. The sparking between two electrodes on a surface does not depend upon the surface resistance (except when moisture is deposited).

Improvements in the process of manufacture have made it possible to produce a thickness of shell of ¾ in. to withstand 100 K.V.; above this small cracks or flaws in the interior are likely

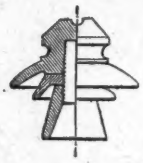
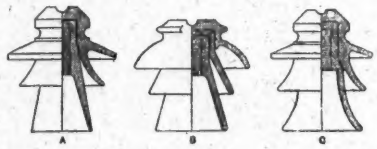


FIG. 1.—SOLID INSULATOR OF THREE SECTIONS BEFORE FIRING.

to occur. The practice in this country and America is to make two-piece insulators for line pressures from 10 to 30 K.V., and three-piece from 30 to 50 K.V.; above this in America four-piece insulators are made up to 70 K.V.; but suspension insulators are rapidly superseding the pin type from 60 K.V. On the Continent the single-piece insulator is general up to 20 K.V., and the two-piece to 60 K.V.

The necessity for providing large air-spaces is due to the flux density, which depends upon the thicknesses of porcelain and air encountered in the path of the flux. At the neck the flux density is greatest. The insulator with large masses of porcelain and narrow air-spaces will not only require a greater charging current, but will also have a tendency to glow in the air-pockets.

As the pin shell has the smallest diameter at the neck of the insulator, the flux penetrating will produce a greater potential



A, English (Bullers); B, American (Locke); C, German (Hermsdorf).

FIG. 2.—PIN TYPES FOR LINE PRESSURES OF 35 K.V.

gradient than the others. Out of 10,480 three-piece insulators tested to a dry flash-over voltage of 195 K.V. for three minutes, 4,172 failed, of which 2,317 failed in the pin shell, namely, about 55·5 per cent. Of the failures, 81·6 involved the pin shell.

The necessity for a large cylindrical air-space between the bolt and the lowest shed is evident. A narrow air-space may lead to brush discharges within, especially when the lowest shed is wet. Curving the lowest shed outwards, a greater striking distance between it and the bolt is provided.

Long insulator parts have a large capacity, and do not resist sudden stresses well. Shorter insulators give a better distribution of the flux, and enable the bolt to be shorter, thus securing additional mechanical strength. Large diameters give increased capacity. Wide and high insulators both give increased electric charge, and flash-over takes place by surface sparks.

The two forms of electric discharge—the brush and surface spark—are responsible for the flash-over of an insulator in the dry state, the brush predominating in the case of small pin insulators, the

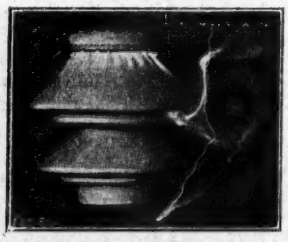


FIG. 3.—SURFACE, PILOT SPARK, AND ARC ON ITALIAN INSULATOR.

surface spark for very large insulators, and a combination of the two forms for medium-sized insulators.

As the pressure on the insulator is gradually increased a glow appears at the neck and extends to a surface brush down the shed, as in fig. 3. The glow may also commence within the pin shed and at joints if the flux densities are high and are sufficient to produce the requisite ionisation. With increase of pressure on the top shed, streamers or surface sparks will form. Meanwhile brush discharges start from the bolt and the line wire, commencing earlier from the wire if placed in the side instead of the top groove of the neck. On small insulators these brush discharges produce the pilot spark, which may reach to the neck *via* the surface brush or direct to the line wire, as in fig. 3, according to the potential gradient acting along these respective paths.

The length of the surface brush is influenced by the humidity of the air, though not sufficiently to affect the flash-over of small insulators. For medium-sized insulators the flash-over voltage is increased 3 to 9 per cent. and for the largest constructed the maximum increase is about 20 per cent. with increase of humidity. When the humidity is 100 per cent. moisture is deposited on the surfaces, and a lowering for all sizes will be produced.

Rain alters the appearance of the discharges, the alteration depending upon the amount and the direction of rainfall. With a fine drizzle and no wind the top surface becomes wet and the glow and surface brush disappear, but give place to glowing drops of water at the edge of the top flange. The flash-over voltage is reduced on account of the diminished spark distance and the point action of the elongated drops. With a more intense rainfall the brush discharges take place from glowing raindrops of one shed to the moist part of another, and the spark selects the shortest path to these conducting places. When the rain stops the moist surfaces are soon dried by the heating effect of the leakage current and by the action of the electric field.

A high potential surge due to a direct lightning stroke or to induction in the neighbourhood of the line may cause one or more

FIG. 4.

FIG. 5.

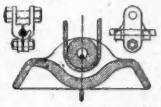


FIG. 6.

FIG. 4.—LONG SHEDDED INSULATOR WITH NICHOLSON'S ARCING RINGS.

FIG. 5.—HERMSDORF METAL SHED PIN TYPE INSULATOR.

FIG. 6.—HEWLETT INTERLINK SUSPENSION TYPE, AND BULLERS' CABLE CLAMPS.

insulators to flash over, on account of the difficulty with which the charges travel along the line to the protective devices. Since insulators are now designed to flash over—rather than to puncture—the question of affording complete protection against damage by arcs is important. A simple method has been devised by Nicholson. He uses two metal rings concentric with the insulator, the lower (of greater diameter than the insulator) attached to the pin, and the upper ring (somewhat larger than the neck of the insulator) suspended from and connected to the transmission line (fig. 4). The rings serve as a safety gap for the arc. That this device has been effective has been shown by tests make on the 60-K.V. three-phase transmission line of the Niagara, Lockport and Ontario Power Co.

FIG. 7.

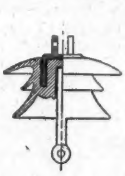


FIG. 8.

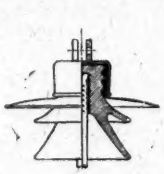


FIG. 9.

FIG. 7.—SUSPENSION SERIES.

FIG. 8.—HERMSDORF SUNKEN-CAP TYPE.

FIG. 9.—HERMSDORF METAL SHED TYPE.

with a 30,000-KW. arc at the line pressure. In no instance was an insulator damaged.

A shorter insulator has been designed which replaces the topmost insulator of the line. Experience shows that more than three-fourths of the insulators broken were top insulators.

The earthed metal ring effects a redistribution of the field. It takes up part of the flux which would otherwise enter the pin shed, thus producing a less flux density and causing a more uniform distribution among the other shells, with less danger to all the shells.

Fig. 5 shows the Hermsdorf patent metal-shed insulator. The metal shed of large diameter effectively protects the porcelain parts against wetting, and its weight and price are less. These advantages are greatest at voltages between 40 and 70 K.V., but below 25 K.V. they are not maintained. The diminution in leakage-path in this insulator is counterbalanced by the protection it offers to rain. Since the brush discharges occur later, and since the production of surface sparks is minimised (being less wet), the insulator can be made shorter.

The increase in line voltage to 110 K.V.* has brought about the introduction and development of the suspended type of insulator, on account of the large increase in weight and cost of the pin insulator required. Above a pressure of 50 K.V. the weight and size of the pin insulator increase rapidly, almost as the third power of the voltage. The price will have a similar relationship.

The weight and price of the suspension units, on the other hand, will increase linearly with increasing voltage, each disk added for increased line pres-ure being identical; 60 K.V. may be taken as the pressure at which the suspension insulator becomes economical.

* A line of 135 K.V. is at present under construction, and higher pressures will be only a question of time until corona on the line wires will be the next question to consider.

The suspension type is better cleansed by rain, its simple construction and comparatively small size give no difficulty in manufacture, and the suspension of the wire below the earthed cross-arm causes less disturbance of the line due to lightning.

One type—the link insulator—has two interlinked, semicircular holes for tie wires. The second type has the metal parts concentric. These consist of a metal cap and a bolt cemented to the porcelain.

With the first type, in case an insulator breaks, the tie wires will still hold the other units together, and, with the ample safety factor, prevent a shutdown. The tie wires may break from the constant rubbing in the holes and from a possible corrosion by ozone produced by any electric discharge in the holes.

Fig. 6, the Hewlett form of the General Electric Company, is made in two diameters, 6 in. and 10 in., of lengths 2½ in. and 2¾ in. respectively. The larger unit has a dry flash-over of about 80 to 95 K.V., and wet 50 to 56 K.V. It is rated for a line voltage of 25 K.V. Four in series are being used on the 80 K.V. Victoria Falls and Transvaal Power Company's transmission line (length 45 miles) in South Africa; but on a new line of the same company five are being specified. The 6-in. diameter unit gives a dry flash-over of about 50 K.V., and wet 30 K.V. Two units in series are used at Hayle, Cornwall, on a 10 K.V. line of Edmundson's Electricity Corporation.

The larger insulators are tested to 3 tons (compression), and the smaller to 1½ tons.

The cemented type can be made so that the porcelain is partly in compression and partly in tension. When an insulator of this type fails under mechanical stress, it is by shear and tension combined.

Fig. 8 is a Hermsdorf type, with a sunken cap, which gives the unit greater mechanical strength and enables the units to be brought nearer together. A mechanical test shows that the first fracturing of the porcelain occurs at 5½ tons: at 8 tons the bolt is torn out. It is to be employed five in series on the first European 110 K.V. transmission line—Lauchhammer-Gröditz. The total height of the

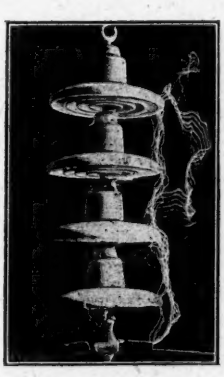


Fig. 10.—Sparking over Flanges of a Suspension Series under Rain.

group will be 3 ft. 9 in., whereas on the American lines the height of suspension groups is 4 to 6 ft. Fig. 9 is a metal-shed form. By curving the metal shed more, better mechanical protection and provision against weather are obtained.

The separation of the shells has introduced large air-spaces, thus the total capacity and charging current have decreased considerably. The distribution of flux density is more uniform than before separation, and therefore there is less liability to puncture. The larger number of units which can be used in contrast with the number of sheds in the pin type, diminishes the flux, the flux density, and the puncture risk; as the line pressures are increased the addition of units gives still the same displacement current. Contrast this with the pin-type insulator, which *increases* in capacity for the higher line pressures.

The relation of dry flash-over voltage is not proportional to the number of units. But the safety factor against flash-over (*i.e.*, ratio of flash-over to line voltage) is made smaller for higher pressures, hence as a first approximation the number of units is proportional to the line voltage.

The curve of (wet) flash-over voltage and number of units is practically linear. This is a great contrast to the pin-type insulator. Thus the factor of safety—namely, ratio of wet flash-over voltage to line voltage—is higher for a suspension series for 110 K.V. than for a pin-type insulator of even 60 K.V.

Flashing over individual units is not desirable, as large power arcs tend to fracture the porcelain.

To safeguard suspension insulators the arcing rings mentioned above can be utilised. For instance, for six units of the type shown in fig. 10 a ring on the topmost cap, another on the line-wire clamp, and one on the middle unit, should amply protect the series from a large power arc.

In view of the increasing demand for high pressure, many electrical porcelain works have installed transformers up to 300 K.V. There are three methods of measuring the pressure: (1) by transformer ratio; (2) by the Kelvin electrostatic voltmeter reading to 100 K.V. and (3) by a spark-gap. In the first method the pressure of the primary is obtained on a Kelvin electrostatic voltmeter (with mirror attachment) and a scale length of 3 ft., corresponding to 120 volts. The range of the voltmeter is increased to 600 volts by a resistance of 100,000 ohms placed across the primary and tapped in five sections. A high resistance (20,000 ohms per kilovolt) placed on the secondary winding of the transformer enables the same voltmeter to read up to 60 K.V. Oscillograph records and the spark-gap enable the maximum values of the pressure to be determined.

With regard to the spark-gap, there is a tendency to measure voltage by the needle-point spark-gap standardised by the American Institute of Electrical Engineers. Those who have worked with the gap specified know that it is difficult to check the American values and even to repeat their own results on successive days. The reason for this lies in the effects on the brush discharge of humidity, pressure, and temperature, position of the needles with respect to the supports and neighbouring objects, and the local conditions of the circuit. The author uses spheres, the diameters being chosen so that no brush discharge, or rather no glow, shall be observed at the sparking voltage. The effect of humidity is eliminated. The effect of temperature can be corrected—the spark potential varying inversely as the absolute temperature. Variations in atmospheric pressure affect the spark potential less before the brush stage than after. Up to 70 K.V. (R.M.S. values) 2 cm. diameter spheres are suitable, to 125 K.V. 5 cm., and 200 K.V. 10 cm.

The spark voltage is determined by the maximum, and not by the R.M.S. value, so that dividing the results obtained with the spark-gap by $\sqrt{2}$, the equivalent R.M.S. sine volts are obtained.

The puncture test is the routine factory test applied to each shell, and the completed multi-piece insulator, to ensure against faults. The shells are tested by inverting and filling with water the unglazed parts where the cement is to be attached to the groove of the neck of the head-piece, and to the bolt-hole in the case of the pin shed. Connections are made to the water inside by brass chains hanging from rods overhead.

Each shell of a large multi-piece pin insulator is designed to have a flash-over voltage equal to the line pressure, the assumption being that it may be subjected to full potential. In the case of a smaller insulator the shells are made to flash-over at nearly twice the line pressure. In general the testing pressure is adjusted to almost the flash-over voltage for each shell and for the complete insulator. The whole insulator cannot, of course, be tested by a voltage equal to the sum total of the testing pressures of the individual shells, as this will be much in excess of the flash-over voltage.

Suspension units, except the interlink type, are tested in the same manner as the pin insulator. The units of the interlink type are each tested between the tie-wires.

There seems to be no uniformity in the duration of test chosen by different firms. In America one minute is chosen, and at one of the German works two hours. At Hermsdorf 15 minutes are taken, but if a puncture occurs, the pressure is applied for another 15 minutes, and so on. There is no doubt that one minute is too short. A total duration of one half hour is quite ample to eliminate the defective shells. A further test when the parts are cemented ensures the elimination of faulty shells.

To determine the puncturing voltage of the insulator, it should be tested under oil. One of the guarantee tests—the dry flash-over voltage—should be made on one of the samples of a batch supported on the pin and (if possible) on the cross-arm, as used under service conditions. The practice of screwing the pin direct into the porcelain leads frequently to breakage of the screw-threads if not of the pin shell. This may be avoided by wrapping the screw-end of the pin with hemp or cementing with Portland cement. An effective practice is to use a lead or malleable iron thimble cemented to the porcelain and threaded to receive the pin. The pin must not be screwed well home, but a small turn-back should be given to allow for expansion, especially for insulators in tropical countries. In the absence of a cross-arm of the exact size as in practice, a bar 2 in. wide will suffice. The bottom shed of the insulator must be at a height above the cross-arm at least equal to its radius. A half-inch solid conductor attached to the side groove with a coiled spring or with a pair of tongs gives the dry test for insulators on corner and dead-end towers. Fixing the conductor on the top groove as ordinarily attached gives a higher flash-over voltage for the insulator. Suspension insulators are tested with the top unit suspended from the cross-arm and the half-inch conductor fixed in the clamp of the lowest unit.

The voltage at which the pilot spark occurs constitutes the flash-over voltage. The humidity, pressure, and temperature should be recorded for each insulator test. This will enable the testing engineer of the insulator works to state the flash-over voltage of insulators for such different localities as a dry and cold mountainous region and a moist and warm plain.

To obtain the flash-over voltage of an insulator under rain conditions in a test room a spray apparatus is employed. A spray which is allowed to fall in a parabolic path gives the most accurate imitation of rain, the inclination of the falling drops being adjusted by tilting the nozzles.

The greatest rainfall ever recorded in this country was 0·3 in. per minute, in Spain 0·4 in. The normal maximum for heavy storms in this country is about 0·16 in. If 0·2 in. per minute be chosen, this will amply cover the normal maximum obtaining. The flash-over voltage is not reduced much with (vertical) precipitations greater than ¼ in. per minute, but within this value the differences in the flash-over voltages are great.

The direction of the spray influences the wet test; with greater inclinations a wider area of the surfaces become wet. From actual tests an angle of 45° gives a mean result, and it is about the direction of rain in a strong wind. The standard precipitation in England and America is ¼ in. per minute, and in Germany 4 mm. at an angle of 45°. It is incorrect to incline the insulator at 45° and have the spray falling vertically on it. A false value of the flash-

over voltage is obtained on account of the water running away in a stream on one side.

To prevent too much splashing, due to the pressure of the water and giving low readings, the minimum distance employed by the author is 5 ft. from the nozzle to the vertical line passing through the centre of the insulator; the tap pressure of water employed is 40 lb. per sq. in. The time element is also very important. No readings should be taken at less than 15 minutes. The humidity, temperature, and pressure should be duly recorded.

Water in the frozen state, as hoar frost, icicles, and snow, is a fair insulator. With a heavy deposit of hoar-frost on all surfaces the leakage is not much greater than with a mist or fog.

Snow falling at a temperature below freezing point will generally form a cap on the head piece of the pin insulator and on the top-most unit of the suspension type. The flash-over voltage is unaffected. Driven snow falling at a temperature above freezing point forms a thawing mass between the sheds or units, and we then have the severest conditions with which an insulator meets. Brush discharges (and even surface sparks) can take place at the line pressure. The following table indicates the leakage loss of an insulator for a line voltage of 6,500 volts under various outside weather conditions.

Weather conditions.	Measurements taken on 300 insulators.	Calculated for 1 insulator.
Dry	15 watts (about)	0·05 watt
Fine dust	46 ,, ,,	0·15 ,,
Fall of snow below 0° C....	70 ,, ,,	0·25 ,,
Heavy rain...	300 watts max.	1·00 ,,
Continued drizzle with 100 per cent. humidity ...	320 watts	1·10 ,,
Stormy wind and very heavy downpour ...	450 ,,	1·50 ,,
Heavy sleet with strong driving wind	650 ,,	2·20 ,,

Icicles below freezing point are as good insulators as snow.

The behaviour of sooty and soiled insulators depends upon the state of the weather. The author has obtained scarcely any difference in the dry flash-over voltages in most severely soot-blackened and dirty insulators, and only a small difference in the voltage at which the initial discharges commence. On a damp day the soot or dirt will attract moisture, which tends to lower the insulation resistance and to start the initial surface discharges with ultimate flash-over earlier than for a clean insulator. Experiments conducted in Switzerland on insulators of various patterns of normal working voltages ranging from 3,000 (Simplon tunnel) to 25,000 (Beznau-Löntsch), blackened under severe conditions, indicate a lowering in the flash-over voltage of 10 per cent. in the dry state and 15 per cent. under the rain test. From a large number of insulators exposed for a number of years to the smoke and dust of a porcelain works, measurements of leakage loss indicate that for clean insulators it is half that of soiled ones. It has been observed that the leakage current over the surfaces attracts soot and dust, especially to the strong parts of the electric field. This attraction for smoke must be duly considered in lines which cross, or are near, steam railways.

The conditions near a sea-coast with its salt fogs are more severe than for an insulator in dry mountainous regions. The salt, perhaps, mixed with dust, encrusts the sheds, and, becoming damp, offers an easy path for discharges. Chemical works adjacent to the line may also produce trouble. In the case of a 50-K.V. transmission line in Norway, near some carbide works, the heavy brush discharges between the bolt and the bottom shed necessitate a periodic cleaning once a month. The suspension type has the advantage of being cleansed by rain and wind in a better manner than the pin type, and for such localities provides considerably less leakage.

DISCUSSION.

PROF. MARCHANT said that one of the best ways of investigating the distribution of stress in the material of an insulator would be by using a modification of the stream line apparatus developed by Prof. Hele-Shaw and others. Regarding the breakdown voltages between two wires wound on a porcelain cylinder, the cube law stated by Mr. Lustgarten was open to criticism. If, in the experiments, the wires had been increased in diameter in proportion to the distance between them, and the cylinder on which they were wound also in the same proportion, a linear law between the voltage and break-down distance should have been obtained.

MR. J. BURTON said that in the question of design, the Continental makers had certainly stepped in advance of us. The nature of the English body enabled our insulators to be made in one piece on the thrower's wheel and not in moulds, and this made them a much more compact and solid article; it also enabled the finished article to withstand a greater tensile strain than was the case with porcelain. The English ware was not so brittle; it was a little stronger, and its puncture value was not quite so high. The design of the insulator was very much more important than the material of which the insulator was made, within certain limits.

MR. H. D. SYMONDS considered that surface discharges, and arcing over porcelain insulators, under service conditions were much more severe than those shown in the photographs, which were taken with a testing transformer. Mr. Lustgarten recommended a 30-minute test, and for porcelain manufacturers with a test room equipped to test many insulators at once, this would be quite satisfactory. For the electrical manufacturer, however, a voltage test of 2½ to 3 times normal working voltage maintained for 5 minutes would be a fair and satisfactory one for discovering faulty insulators. If, at the end of that time any rise in temperature had taken place on any insulator, it should be continued for half-an-hour. He endorsed the author's recommendation that puncture tests on porcelain should be conducted under oil; only under such conditions was it possible to obtain an accurate and reliable value for the dielectric strength. It had been his experience that, on the whole, the English porcelain was superior from an electrical point of view to the German material. The dielectric strength of the English porcelain was generally a little higher, and the material was tougher and more free from air bubbles than the German porcelain. Tests that were made with dirty insulators depended so much on the dirt that was used, that it was not safe to assume that the flash-over voltage was not appreciably reduced by the accumulation of dirt on the insulator. The condition of the dirt and its ingredients enormously effected the result, and often the difference was only apparent on long-time high-voltage tests.

MR. POLLARD DIGBY said that the author's experiments had been conducted presumably with Manchester tap water, which was probably far purer than Manchester rain water. The author's commercial tests were both excellent and practical. The note in regard to sooty insulators, which, in a dry condition, are practically as good as clean insulators, offered an interesting parallel to the case of switch oils, which had practically the same dielectric strength when black through suspended carbon as when newly received.

MR. A. B. MALLINSON said that one of the first things which impressed one when proceeding to install a high-pressure line, was the great variety of insulators offered, each type being claimed by its maker to be better than any others. He had found by actual experience that it was necessary to multiply what the manufacturer said by about four, to get an insulator which was really satisfactory. It was not that he had experienced flashing-over on them, but that on a line in a manufacturing or colliery district, such a poor insulation test was obtained, that it was not possible for the engineer in charge to get a true idea of the state of his equipment without insulating the line, and individually testing the sections of the equipment. For instance, at a colliery working at 2,500 volts, the insulators supplied by the maker for a 5,000-volt line were quite useless, as unless they were cleaned every month or so, it was impossible to get an insulation test of more than about 0·1 megohm on a line only 0·4 mile in length.

MR. R. G. CUNLIFFE said he thought many engineers who had used porcelain insulators would appreciate the difference between moulded and disk spun insulators. It had been his experience that moulded insulators broke, owing to internal stresses, under the action of very slight shock. He agreed that there was objection to artificial rain water tests, as he had found great variation in specific resistance between different samples of tap water. The water used by the author from the Corporation mains was of very high specific resistance. He agreed that a coating of soot or carbon on the surface of an insulator would not have any effect in dry weather, but thought that in wet weather the effect of such a conducting coating would be to give the insulator the properties of a "metal shed" insulator.

MR. A. TEIXEIRA said he noticed the author stated that the metal shed units did not insure the arc passing from metal to metal. The arc started from the bolt to the metal shed in each insulator, and not from metal shed to metal shed. This was due to the fact that the distance between the metal sheds was very great. The arc would pass from metal shed to metal shed if the sheds were near together, as in the case of the sunken cap insulators.

MR. W. CRAMP said the author had done the electrical and porcelain industries a great service by calling their attention to the fact that surface leakage was not really important, if the question of capacity was looked after properly. This point could not be too often emphasised.

MR. LUSTGARTEN, in reply, said that the cube relation of the spark distance and spark voltage was referred to in the paper only when the surface spark condition obtained. When, irrespective of the size and curvature of electrodes, and irrespective of the thickness of the dielectric, a high potential gradient and a great charge density produced the surface sparks, the relation would be cubic so long as the flashing-over was wholly due to those sparks; but if flashing-over was due to a combination of the surface spark and the brush discharge, as in the case of a medium-sized pin insulator, or as in the case of the large interlink-suspension insulator, the relation would be intermediate between a linear and a cubic law. The greater the dielectric constant of the medium between the electrodes, the greater the tendency to produce the surface sparks. Given large capacities, whether due to suitable dimensions of electrodes, to dielectric between or to ionised air adjacent to electrodes, the surface spark resulting would give a cube (for large distances a fourth power) relation for the spark length and spark voltage. Near chemical works and the sea-coast the curved insulator underwent a better cleansing action by rain, and could be more efficiently cleansed during a periodic overhauling by the linesmen. As the working of a transmission line depended largely on complete safety against puncture of an insulator, the duration of the routine factory test of the pieces and the whole insulator should not be curtailed. The puncturing of the faulty insulators became less as the time of test increased, but was never entirely eliminated; the reliability against puncture was, therefore, greater after half an hour's test than five minutes. The insulator whose temperature rise was 50° C. and above should be discarded. The corrugated tube had been largely superseded by the smooth tube for bus-bar and switch insulators. Artificial rain experiments with salt and distilled water gave no difference in the wet flash-over voltage. The voltage would depend on the brush discharge, and the potential gradients at the water drops would not be sensibly different for salt or distilled water, especially as the leakage currents were so small.

Domestic Electricity.

(*Third Informal Discussion at the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, May 2nd*, 1912.)

IN opening this meeting, the President observed that more speakers than ever had handed in their names, but that it would be impossible to prolong the discussion beyond that night.

MR. W. R. RAWLINGS said that from his experience of the consumer, it was surprising how many people had no idea that heat was obtainable from electricity, and as there was also an impression that electricity was costly, there was considerable scope for the publicity people to remedy this. The consumer had great difficulty in understanding many of the tariffs, and he (the speaker) considered that no tariff should necessitate the use of more than one supply service. He had known cases where as many as four services were used, any one of which should have been sufficient ; moreover, apparatus was very frequently returned by people who discovered that the alternatives were paying for energy at higher prices or installing separate wiring. The supply authorities had too many fads and special fittings. He disagreed with Mr. Faraday Proctor's views, as that gentleman had shown that municipal councils could not be trusted to manage their departments on commercial lines, while he claimed that the contractor did know his own business. There was a great need of co-operation amongst all parties, also for some standard of apparatus which would reduce the amount of stock. Politically, he would grant full powers to municipalities to hire out all expensive apparatus, as they were better fitted financially than the contractor for this work ; and if the municipal authorities would agree to others fixing the apparatus, he felt sure they would work together harmoniously. If the engineers, contractors and manufacturers would meet together amicably and discuss matters, the industry would go ahead.

MR. HOLMES (Marylebone) said he was in the position of selling both apparatus and energy to consumers. Price was now no deterrent to electrical heating, providing a suitable tariff, not requiring duplication of services, was offered, and that suitable apparatus was installed and properly used. Those who had experience with electric cooking knew its superiority ; a suitable tariff was not so essential as regarded the wiring question, because some extra wiring would be necessary. The chief fault was in the apparatus, although the manufacturer would not admit it ; he could see no advance in the design of apparatus during the past five years. The manufacturer and contractor had no interest in apparatus after it was paid for, but its subsequent service particularly affected the consumer, and it was necessary to keep in touch with it. There was no serious reason why electric cooking should not be adopted at 1d. per unit. It did not necessarily add to the peak load, as there was a great diversity factor. In regard to the last speaker's remarks, he believed the contractors had consistently opposed "hiring out" by local authorities, and he asked whether the announcement was official. In conclusion, he urged the necessity of a special advertising and sales organisation, which could do work which many contractors were obviously unfitted to do—the consumer must be the first and last consideration.

MR. LEONARD TATE (Electrical Contractors' Association) pointed out that the contractor could not afford to neglect the consumer at any time, as the latter influenced future work. Moreover, "hiring powers" had been available to any municipality who cared to adopt them, for some years. He quoted figures to show that a higher energy consumption per lamp had been obtained in towns where all the work was in the hands of contractors. The "Hackney" clause, to which reference was made in a previous meeting, was in the L.C.C. General Powers Bill. He added that the different pressures in use in various areas deterred the consumer from buying expensive apparatus, which might be only suitable in one place, and for this reason the Electrical Contractors' Association had agreed to the question of "hiring powers," as mentioned by Mr. Rawlings.

SIR JOHN MCDONALD said in this country we always distrusted anything new, but in America a new thing was carefully considered to see what use could be made of it. Speaking as one of the public he thought that popular lectures would reach a great many people, who could not be reached in other ways. The industry must be prepared to spend money on advertising, as in the case of any other commercial undertaking.

MR. C. S. VEREY BROWN considered that the industry would expand more rapidly if certain legislation, individual, and tariff defects were removed. The rigid adherence, in the case of a municipal supply, to the principle of making every consumer contribute to the profit (not only to the revenue) tended to check the use of electricity—he recalled the case of the "Swings and the roundabouts." He had used electric cooking for six years, and during that period had never had anyone in to replace heating elements, because they were easily replaced at home. He further added that the unit was an indefinite quantity to the ordinary consumer, who also held back sometimes because of the contradictory advice he received as to whether A.C. or D.C. was the best in his particular case. He suggested that an effort might be made to standardise supply pressures, and thus simplify the supply of lamps, apparatus, &c., as this had caused considerable annoyance to consumers in the past. He considered that the electrical industry suffered from too much individuality ; while this was a good thing in its way, it would be better if the introduction of new and untried appliances were controlled by responsible bodies.

MR. A. C. CAMPBELL SWINTON disagreed with the last speaker's views as to new appliances ; it was very often the people who knew most who ventured the least, while the outsider, undeterred by future difficulty, plunged in and accomplished something. Still, it was necessary to keep in touch with apparatus after it was in use. He asked—Was it possible for electric cooking apparatus to be placed on the market with the same relative profit margin as in the case of gas apparatus ?

MR. DOWSING discussed the early efforts at electrical heating and cooking following the Crystal Palace Exhibition of 1890. The business lasted for a year or two in connection with private installations, there being no public supply then. When the latter came the price was too high. The supply engineers had hindered the introduction of electric cooking, and he believed the gas engineers adopted the same attitude until the coming of electric lighting compelled them to turn their attention to its possibilities. He strongly urged the value of a school of electric cookery, granting suitable diplomas, the graduates of which would spread the knowledge of, and demand for, electric cooking.

MR. J. S. HIGHFIELD agreed as to the necessity for simple charges (involving not more than one service per house), and as to the utility of standard voltages, if only they were possible. The hiring out of apparatus was the great thing to aim at, and apparatus should be made convertible for various voltages, so that its utility would be increased. He thought the electrical industry was going ahead more than ever before, but joint action was necessary in order to push business. He emphasised the necessity of keeping in view the earning of sufficient profit to induce people to put money into the business.

Another speaker, who had apparently adopted electricity for every possible purpose in his house, said that his total bill for light and heat (including two tons of coal) amounted to £10 per annum ; his maximum load was 5 KW.

EXPIRING PATENTS.

(*Continued from page* 739.)

15,203. July 11th, 1898. "Dynamos." M. DERI. Relates to field magnets for continuous current generators or motors, with two or more poles. The iron of the magnet is a hollow cylinder of uniform section surrounding the armature, and is wound with two groups of coils, one group being permanently connected in series with the armature, and tending to produce a field in opposition to the current in the armature. By this means the field produced by the other group of coils remains in a fixed position while the armature current may be varied, or the rotation reversed.

16,129. July 23rd, 1898. "Electrolysis." O. IMRAY. (Oesterreicher Verein fur Chemische und Metallurgische Production ; Aussig on the Elbe, Bohemia). Relates to the continuous electrolysis of solutions of alkaline salts, especially alkaline chlorides, to obtain the corresponding hydrate solution and chlorine gas. The anode is covered by a bell which extends some distance below it, while the cathodes are outside the bell and generally at a lower level. The electrolyte is introduced through a tube to the top of the anode compartment. The chlorine, as it is formed, passes up through the anolyte thereby agitating and mixing it, and escapes through a tube. By this arrangement the layer formation of the anode and cathode liquids is maintained without the use of a diaphragm.

16,814. August 3rd, 1898. "Photo-telegraphy." F. SILBERSTEIN, A. POLLAK and J. VIRAG. Relates to a system of photo-telegraphy in which light passed through or reflected from a message, &c., is projected by lenses on to a number of selenium cells. The cells are connected to a distributor and to a line wire. Light from a source is reflected from a mirror on to the face of a reflecting polygonal prism, after which the beam of light falls on a slit in a chamber containing photographic paper. The receiver is synchronised with the transmitter. The receiver source of light is preferably a triangular hole in a screen. To produce damping in the telephone vibrations the distributor contacts may be doubled, two contact brushes or arms being employed ; two reversed batteries may also be used, one of them being permanently to line. In a modified form of receiver, a number of magnets operating wedge-shaped shutters, are operated by a distributor similar to that used at the transmitter station. The wedge shutters control a series of openings corresponding in number to the selenium cells.

18,261. August 25th, 1898. "Telegraph relays." S. G. BROWN. Relates to relays for cables and other telegraph work. A coil is connected to line and mounted in the field of a magnet, and is either connected by two threads or by a rigid attachment to a second coil arranged in the field of an alternating-current magnet. The coils of the alternating-current magnet and the coil are connected respectively to a commutator and a rectifier. The commutator is also in circuit with a battery and the rectifier is connected by lines to the receiver or the next section of the cable, &c.

18,613. August 30th, 1898. "Telephone systems." J. E. KINGSBURY. (Western Electric Co., U.S.A.) Relates to improvements in telephone systems. At the subscriber's station a high-resistance microphone having about one-third the usual amount of carbon granules may be employed, an ordinary receiver being connected in a loop circuit with a condenser. The bell may be arranged as a shunt across the receiver. The current is supplied from a central station generator arranged across the loop, and having impedance coils on either side connecting it to the loop. When a dynamo charging secondary cell is employed, the interruptions of the current are deadened either by the insertion of impedance coils in the generator mains, or by making the armature and commutator with a large number of sectors, so that the interruptions would form a very high note.

19,246. September 9th, 1898. (Date claimed under Sec. 103 of Act of 1883, February 10th.) "Electric distribution." B. G. LAMME. Relates to the transformation of direct currents to alternating currents by means of a rotary transformer or converter. In order that the speed or rate of alternation may be approximately constant, irrespective of changes in the inductive load, a small direct-current generator is employed for exciting the field magnets of the rotary converter.

20,008. September 21st, 1898. "Electric switches : cut-outs." M. LAWTON (trading as J. Lawton & Sons). Relates to the manufacture of metallic covers for switches. The blanks are stamped or rolled out of a thick plate, and the rolls, &c., are so formed that the centres or edges of the plate are left sufficiently thick.

20,206. September 23rd, 1898. "Ozone." E. ANDREOLI. An ozoniser consists of a glass tube coated internally with metal foil or deposited metal, or with a thin layer of a metallic or carbon powder and surrounded externally by metal rings connected by slotted longitudinal bars. The distance is maintained by providing the tube with enlargements on which some of the rings rest.

20,274. September 24th, 1898. (Date claimed under Sec. 103 of Act of 1883, February 28th.) "Controlling electrically-propelled trains." F. E. CASE. Relates to means whereby any number of electric motors on cars, when coupled to form a train, can be controlled from a single point on the train. Each master controller has three switches for power, reversing, and braking respectively and the motor controllers are similarly divided. An additional source of power carried on the vehicle supplies current for working the motor controllers and the brakes. This current is obtained from a battery which is charged by a motor generator worked from the main circuit, an automatic cut-out being interpolated.

20,275. September 24th, 1898. (Date claimed under Sec. 103 of Act of 1883, February 28th.) "Controlling electrically-propelled trains." E. THOMPSON. Relates to means whereby any number of electric motors or cars when coupled to form a train can be controlled from a single point on the train. Each car is complete in itself, with motor and controller equipment, and master controllers are provided on the train in the different cars to work the motor controllers by a shunt off the main current.

20,276. September 24th, 1898. (Date claimed under Sec. 103 of Act of 1883, February 28th.) "Controlling electrically-propelled trains." W. B. POTTER. Relates to means whereby any number of electromotors on cars when coupled to form a train can be controlled from a single point on the train. Each car is complete in itself, with motor and controller equipment, and master controllers are provided on the train in the different cars. The motor controllers are worked from the pneumatic pressure brake pipes, but the valves which determine the admission to the operative parts are electrically controlled from any one of the master controllers.

20,440. September 27th, 1898. (Date claimed under Sec. 103 of Act of 1883, May 7th.) "Measuring electricity." H. P. DAVIS, F. CONRAD. Relates to current meters for alternating currents. A laminated electromagnet is excited by current supplied to a coil. Closed circuit coils surround parts of its poles, the currents induced in them producing a shifting of the magnetic field in the air-gap of the core and turning a conducting disk carried by a shaft in opposition to a spiral spring. The shaft carries a pointer over a graduated circular dial.

(To be concluded.)

NEW PATENTS APPLIED FOR, 1912.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

9,442. "Portable electric reading lamp." S. J. LEVI, T. A. ROSE, and A. H. ROSE. April 22nd.

9,466. "Automatic brakes for electric tramcars and the like." COUNT F. C. V. DI CASTELLETTO. (Convention date, April 22nd, 1911, Germany.) April 22nd. (Complete.)

9,492. "Electric-ignition device for combustion engines." H. BAUER and M. ECKMEIER. April 22nd. (Complete.)

9,499. "Methods of and application for obtaining simultaneous radiographs." SIEMENS & HALSKE AKT.-GES. (Convention date, April 21st, 1911, Germany.) April 22nd. (Complete.)

9,502. "Electro-magnetic vibrators." A. H. NICHOLSON. April 22nd. (Complete.)

9,520. "Means for attaching wires and cables to insulators." H. PARRA. (Convention date, May 1st, 1911, France.) April 22nd. (Complete.)

9,539. "Magneto attachment." J. WELLER. April 22nd.

9,580. "Luminous electric devices." L. H. WALTER. April 23rd.

9,587. "Anodes used in the electrolysis of metallic solutions." F. HODGSON. April 23rd.

9,593. "Method of charging storage batteries." D. H. WILSON. (Convention date, April 24th, 1911, United States.) April 23rd. (Complete.)

9,596. "Mechanically-operated search-lights." M. L. SEVERSON and W. S. SPIEGELBERG. April 23rd. (Complete.)

9,609. "Electrolytic process for cleaning metal articles." LANGBEIN-PFANHAUSER WERKE AKT.-GES. (Convention date, April 25th, 1911, Germany.) April 23rd. (Complete.)

9,612. "Electrolytic process." C. J. REED. April 23rd. (Complete.)

9,637. "Apparatus for actuating conduit covers and collector ploughs of electric railways." D. SAMAIA. (Addition to 23,495, 1911.) April 23rd. (Complete.)

9,644. "Synchronous dynamo-electric machines." E. ROSENBERG. April 23rd.

9,647. "Electric circuit-breakers and the like." E. A. FAGERLUND. (Convention date, April 24th, 1911, Sweden.) April 23rd. (Complete.)

9,706. "Electric incandescent lamps." G. A. LEE. April 24th.

9,714. "Telephones." C. F. KILLAR and J. C. GROVE. April 24th.

9,733. "Telegraphy." E. S. HEURTLEY. April 24th.

9,734. "Insulators." T. WITTRIN. April 24th. (Complete.)

9,735. "Methods and apparatus for charging storage batteries." D. H. WILSON. (Addition to 9,593, 1912.) April 24th. (Complete.)

9,751. "Apparatus for phonographically recording telephonically transmitted conversations." FIRM WALSECK & STARCKE. (Convention date, October 30th, 1911, Germany.) April 24th. (Complete.)

9,752. "Apparatus for phonographically recording telephonically transmitted conversations." FIRM WALSECK & STARCKE. (Convention date, November 25th, 1911, Germany.) April 24th. (Complete.)

9,753. "Protective arrangements for electric distribution systems." A. REYROLLE & Co., LTD., and H. K. TRECHMANN. April 24th.

9,771. "Electric-sign system and apparatus therefor." E. M. WILDEY and H. C. MERRETT. April 25th.

9,789. "Magnetic toys." A. G. OWEN and J. F. BENNETT. April 25th.

9,804. "Electro-magnets." A. T. DOWDELL. April 25th.

9,806. "Electric incandescent lamp-holder with locking device." J. G. J. MACSHEEHY. April 25th.

9,814. "Rheostats, motor-starters, and like apparatus." A. E. RALPH and L. WEEKES. April 25th.

9,828. "Disk armatures for continuous-current electric meters." SIEMENS-SCHUCKERTWERKE G.M.B.H. (Convention date, April 26th, 1911, Germany.) April 25th. (Complete.)

9,826. "Wireless signalling and the like." E. O'TOOLE. April 25th.

9,861. "Construction of electric-heating devices." G. COOPER. (F. Boelling, Germany.) April 25th. (Complete.)

9,876. "Apparatus for controlling direct-current electric motors." SIEMENS BROS. DYNAMO WORKS, LTD., and F. LYDALL. April 25th. (Complete.)

9,900. "Devices for adjustably suspending electric and other lamps, electroliers, gas pendants and the like." W. H. STURGE. April 26th. (Complete.)

9,901. "Grip fittings for electrical conduits, junction boxes, ceiling boxes, cut-out boxes and the like." F. E. FORRESTER. April 26th.

9,908. "Obtaining motive power in combination with electricity and the apparatus employed therein." J. MACNAB. April 26th.

9,909. "Electric fixtures." S. TROOD and J. H. DALE. April 26th. (Complete.)

9,910. "Outlet boxes." S. TROOD and J. H. DALE. April 26th. (Complete.)

9,911. "Electric fittings." S. TROOD and J. H. DALE. April 26th. (Complete.)

9,941. "Manufacture of electric incandescent filaments or bodies." F HANSEN and W. F. MOHR. April 26th.

9,981. "Process for the manufacture of drawn tungsten wires or the like." C. H. FISCHER. April 26th.

9,983. "Incandescent electric lamps." W. J. LUSTED. April 26th. (Complete.)

10,009. "Electrically-heated ovens." VERITYS, LTD., and W. G. PIPKIN. April 27th. (Complete.)

10,029. "Electrical heating units." E. C. R. MARKS. (Landers, Frary, and Clark, United States.) April 27th. (Complete.)

10,032. "Protective devices for electric power systems." G. ELLISON and M. R. H. MUELLER. April 27th. (Complete.)

10,041. "Telephonic headgear." E. A. GRAHAM. April 27th. (Complete.)

10,053. "Submarine cables." SIEMENS & HALSKE AKT.-GES. (Convention date, April 28th, 1911, Germany.) April 27th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

ELECTRICAL HEATING APPARATUS. E. G. Byng and C. H. Archer. 28,779. December 21st.

THERMO-ELECTRIC GRAVITY MOTOR. E. E. Rouse. 7,886. March 24th. (September 25th, 1911.)

ELECTRICAL TIME-SWITCHES. S. Chiger. 8,585. April 6th.

BRUSHES FOR DYNAMO-ELECTRIC MACHINES. G. Engich. 8,656. April 7th.

ELECTRICALLY-CONTROLLED GRAB HOIST GEAR. K. Brüll. 8,798. April 8th. (October 10th, 1910.)

WIRELESS TELEGRAPHY. Sir O. J. Lodge and E. E. Robinson. 8,806. April 8th.

METHODS OF AND MACHINES FOR MAKING BATTERY PLATES. W. E. Lake. (United States Light and Heating Co.) 8,814. April 8th.

HAND AND BELT ELECTRIC LAMPS. W. Thomson. 8,846. April 10th.

ELECTRICAL MEASURING INSTRUMENTS. W. E. Lake. (Weston Electrical Instrument Co.) 9,000. April 11th.

ELECTRIC ARC LAMPS. J. S. Hecht and A. T. Dowdell. 9,072. April 12th.

MAGNETIC COMPASSES. Kelvin & James White, Ltd., F. W. Clark and H. W. P. Chetwynd. 9,347. April 15th. (Cognate application, No. 18,630 of 1911.)

CONSTANT-SPEED DEVICES FOR DRIVING MOTOR-CAR, LIGHTING, AND LIKE DYNAMOS. L. van Celst. 11,788. May 15th. (May 14th, 1910.)

SOLDERING OF ELECTRIC CONDUCTORS AND THE LIKE. C. E. Egner. 11,841. May 16th.

AUTOMATIC REGULATORS FOR DYNAMO-ELECTRIC MACHINES. H. Hirst and A. E. Angold. 13,477. June 6th.

REGULATION OF ELECTRIC GENERATORS DRIVEN AT VARYING SPEEDS. British Thomson-Houston Co. and A. P. Young. 13,650. June 7th.

MEMORANDUM AND LIKE APPLIANCES FOR USE IN CONNECTION WITH TELEPHONE AND OTHER PURPOSES. E. F. M. Branson and F. H. Bowden. 16,394. July 24th. (Cognate application, No. 120 of 1912.)

AUTOMATIC REGULATING MECHANISM APPLICABLE TO ELECTRIC GENERATORS. L. V. Grillet and J. B. Truchetet. 17,419. July 31st.

INDUCTIVE WIRELESS TELEPHONE AND TELEGRAPHIC INSTALLATIONS. H. von Kramer. 17,634. August 3rd.

ELECTRIC SWITCHES. H. A. Crabb, A. H. F. Perl and C. H. Hutchinson. 18,667. August 19th.

ATTACHMENT FOR INSULATOR-CARRYING ARMS TO TELEGRAPH AND LIKE POLES. Bullers, Ltd., and E. H. Chambers. 18,680. August 19th.

MANUFACTURE OF ELECTRICAL COILS. W. E. Lake. (Weston Electrical Instrument Co.) 19,116. August 24th. (Divided application on No. 9,000 of 1911. April 11th.)

SYSTEM OF ELECTRIC PROPULSION FOR VEHICLES. J. T. Lister. 19,747. September 5th.

AUTOMATIC ELECTRIC CIRCUIT-BREAKERS. J. Cuculic. 20,161. September 11th.

ELECTROMAGNETIC RECIPROCATING MOTORS. W. E. Lake. (Dulles-Baldwin Electric Drill Co.) 21,806. October 3rd.

ELECTRICALLY-HEATED SOLDERING IRONS. Evershed & Vignoles, Ltd., S. Evershed and W. Clark. 24,933. November 8th.

TELEPHONE CABINET TO ENSURE PRIVACY OF CONVERSATION. J. J. Webb. 26,296. November 24th.

ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES. C. F. Kettering. 28,589. December 19th. (Divided application on No. 5,902 of 1911. March 9th.)

1912.

ELECTRIC VAPOUR APPARATUS WITH SEVERAL LIQUID ELECTRODES. Ges. für Elektrotechnische Industrie. 4,588. February 15th. (November 10th, 1911.)

MEANS AND APPARATUS FOR STORING AND TRANSPORTING INCANDESCENT ELECTRIC LAMPS. E. H. Archer. 2,319. January 29th.

INTERCOMMUNICATION TELEPHONE SYSTEMS. E. R. Corwin. 3,098. February 7th.

The Lighting of the Ideal Home.—The Exhibition at Olympia is over, but perhaps it is not too late to draw attention to the inefficient, inartistic and altogether un-ideal methods of lighting employed in the Ideal Home. The organisers, who had built, decorated and furnished the house in an extremely beautiful and convenient manner, seem in the matter of artificial lighting to have had no ideas beyond the glare-accentuating conical opal shade and some common patterns of so-called ornamental shades which do nothing but absorb from 20 to 50 per cent. of the available light. Why was no advantage taken of the several types of efficient prismatic glass reflectors, or of one of the recent forms of indirect lighting? Either of these systems of lighting would have provided an illumination far and away more economical and beautiful than the unfortunate method actually employed. The least we can hope is that the organisers of the next Ideal Home Exhibition will have learned in the interim to appreciate the importance of efficient lighting in the domestic scheme.